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The Outlook

Accidents and Fire

CORRESPONDENCE in this journal, preceding and following the article "Towards Greater Air Safety" published on May 20th, has served to focus attention on the regrettably high proportion of aircraft accidents which are followed by fire and loss of life. It has been suggested that the use of diesel engines, with their fuel of high flash point, would be one way of reducing this particular danger. Sound reasons why the development of the diesel type of power plant is not now a practical proposition have been convincingly stated, first by Air Commodore Banks and, last week, by Sir Roy Fedden. Both have had extensive experience of aircraft engine development, and their views cannot be disregarded. It appears obvious that the diesel is "out" so far as aircraft is concerned, except possibly in the "triple-expansion" form referred to by Sir Roy Fedden last week.

In a very timely article in the July Journal of the Royal Aeronautical Society, Mr. R. E. Hardingham, Secretary of the Air Registration Board, examines the general position of aircraft accidents and the problem of how the survival rate can be increased. His researches have shown that more than 90 per cent of all accidents are caused not by lack of airworthiness but by operational circumstances, and that something like 70 or 80 per cent of all fatalities are caused finally by burning. Of these, Mr. Hardingham considers, probably 20 to 30 per cent could have escaped in time but for physical injury, or through having been trapped in the wreckage.

To minimize the risk, Mr. Hardingham suggests that fuel tanks of the bag type are the safest, and that tanks should be mounted in the wings as far as possible from the fuselage but not so far out in the wing as to be liable to rupture in a one-wheel or sideslip landing, and never in the centre-section of a low-wing monoplane.

As for the sources most likely to start fires, Mr. Hardingham mentions engines and the electrical system, and advocates automatic crash switches to actuate fire-extinguishing systems which drench the engines and isolate the batteries from all heavy-duty circuits and from as much other wiring as possible. Tank sumps, pumps, collector boxes and fuel lines should be mounted in strong parts of the structure and not in an excrescence under the aircraft, where they will be ripped off.

Crash Survival

OTHER sources of fatalities in aircraft crashes are physical injuries and the trapping of occupants. Mr. Hardingham comes out as a strong advocate of backward-facing seats, a subject which has been much debated, and which airlines generally tend to avoid because, they say, passengers dislike facing aft. We do not believe that passengers feel very strongly on this point, and if they were assured, as they should be by Mr. Hardingham's statement that this type of seat can be designed to afford protection at decelerations as high as 25 "g," that facing the tail is a real safety measure, we believe few would object.

Mr. Hardingham proves himself something of a psychologist when he states that, after a crash, passengers forget everything but the door through which they entered, and he suggests that there should be at least one main door on each side at the rear where distortion is least.

It might be argued that all these suggestions are impracticable because of the weight entailed and the inroads it would make in the payload. We do not accept that as a valid argument. If crashes continue to occur, as we fear they will until better ground organization has become universal, and if passengers continue to be burnt to death after too great a proportion of accidents, as they will do if strong measures are not taken, the number of empty seats in airliners will reduce payload to a far greater extent than would the safety measures suggested.

Long Range Airliners—Cabinet Decision

IN a day or two the Minister of Civil Aviation is expected to make known the decision reached by the Cabinet and its sub-committee on the vitally important question of aircraft for our Empire routes. It is reported that delays have been occasioned by lack of unanimity at cabinet level, and this is not, perhaps, surprising in view of the many major considerations involved. In our leader of July 1st, "Fly British," the main alternatives were discussed, and much as we dislike slogans as such, this title, which is supported unanimously by British industry, must continue to represent *Flight's* policy.

Disappointing as it is, the fact must be accepted that the so-called interim period in air transport, over which we were to be tided by converted wartime aircraft, will be of much longer duration than had been expected. Moreover, the development of a modern airliner is obviously not a task which can be hurried, however great the urgency, without jeopardizing its chances of success. Strangely enough, our strength in the form of gas turbine power units has complicated the issue by offering, tantalizingly, great advantages in suitable airframes, a combination which, however, still seems to remain just around the corner.

Thus we face the autumn of 1948 with a great need for good long- and medium-range aircraft for the Middle and Far Eastern routes, and for those to Australia, Africa and South America. To meet this requirement we have a number of Tudor IVs and others to be converted. These must be employed at all costs. In addition we have a very promising medium-range design, the Hermes, of which the Mark 4 should be ready for delivery in fair numbers commencing next January, and Mark 5 deliveries with turbine power units should follow on directly. Finally, we have the large number of Tudor IIs, which are nearing completion, but the employment and usefulness of which is questioned and is the subject of the Courtney report, not yet public.

Some of these large, fully pressurized machines built for Empire passenger services may be usefully employed as high-altitude flying test beds for several types of gas turbine in the same way as a single Tudor, the Mark 8 is already being fitted with Nenes. No other airframe is so suitable, and the need for such research for both future civil and military aircraft is now urgent.

It would appear then, that without cancelling any orders placed in the British industry, and by employing available types in the most suitable manner, there is still a requirement for more machines which some contend must come from abroad. The alternative, which no one would advocate, is to let competitive airline operators open up new long-range services and extend and expand facilities on existing ones, while we sit back and wait. This, to a country which intends that one day its influence and activity in air commerce shall match the unique and enviable position traditionally enjoyed by its mercantile marine, is inconceivable.

What types of aircraft we buy abroad, if one accepts that the urgency of the position makes this inevitable, is governed by availability of aircraft which are both competitive and capable of economical operation. Constellations we know and like, Canadair Fours, produced by an American-owned company in Canada, promise well, and have British power units. To obtain sufficient numbers of aircraft quickly, it may be found necessary, as well as politic, to order some of both. In either case, spectacular results cannot be expected for several years and our view is that we must be prepared for the corporations to continue to make considerable though diminishing losses for, at the very least, two or three more years. A natural fear has been expressed that the tendency will be to place repeat orders in the future. Even when operating most efficient aircraft available over suitable routes, the sixteen major operating companies in America made a collective loss of £5¼ million in 1947—a fact which few people seem to recognize.

If the decision is to buy abroad, it will be the duty of the Ministry of Supply to make sure that the productive capacity and development of the British Aircraft Industry is assisted in every way possible to offset undesirable but inevitable actions forced upon us by the slow recovery of war-handicapped Europe.

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THE KING'S COLOUR: Flight Cadet Sergeant H. A. Caillard receives the Colour from His Majesty during the presentation ceremony at Cranwell last week.

GUST HUNTING

Work of the B.E.A. Gust Research Unit at Cranfield

DURING the war, when height had as great advantage as speed, the upward leap of operational altitudes brought many curious things to light, among them, clear-air gusts. These phenomena were first experienced by aircrew flying at heights of the 30 to 35,000-ft order, and reports began to be made of meeting strata where aircraft were jerked up and down as though running over a corrugated runway. At that time, of course, everyone was far more concerned with destructive intent than with the gathering of scientific data, and although the existence of these phenomena in the upper air was noted, nothing was done about investigating them.

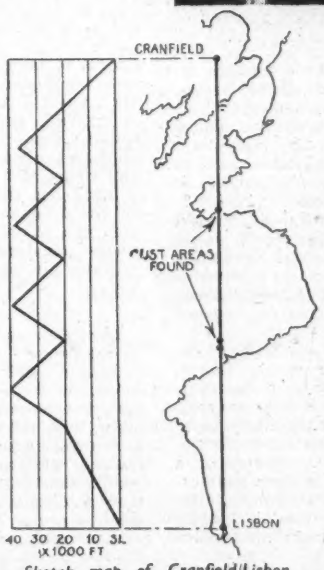
The random reports did, however, eventually filter through to the scientific interests, where they were noted and earmarked for future investigation. Thus it was that, something over two years ago, word was bruited about of the implications of clear-air gusts on aircraft operation, from aspects of structural design and passenger comfort.

As an aircraft is submerged in its suspending medium, it is patent that any motion of the air mass in which the aircraft is flying will be transferred to the aircraft relative to the ground. Thus, when a machine flies from undisturbed air into a region where the air is moving bodily upward, a consequent upward acceleration will be imposed and, for a given vertical speed of air movement, the violence of the acceleration imposed on the aircraft will be a function of its air speed. With the present order of cruising speeds and altitudes, the influence of clear-air gusts is, perhaps, of no great importance; but the constant trend is toward ever-increasing speeds, coupled with increase in operational height in order to take advantage of "over-weather" conditions and reduction in drag. It is, therefore, chiefly in relation to the future that gust effects take on a complexion of importance.

History

Mr. N. E. Rowe, Controller of Research and Long-Term Development, British European Airways, felt that flight research into clear-air gust conditions was a necessity, since only by the gathering of factual evidence could the whole nature of these phenomena be understood and, if necessary, action taken to negative their effect. The Ministry of Supply were agreed with Mr. Rowe's reasoning and gave official approval to the setting-up of a Gust Research Unit by B.E.A. The difficulties attendant upon the operation of suitable research aircraft, and the maintenance of such aircraft, were considered to render the use of Northolt as a base for the Gust Research Unit out of the question. After a wide survey, it was decided that the College of Aeronautics at Cranfield offered the best facilities, and an arrangement was made with the College to that end.

Capt. T. T. Thomas (left), the research pilot, and N/O. D. L. Jones standing in front of one of the two Mosquito PR34s used by the G.R.U.



Sketch map of Cranfield/Lisbon flight track and vertical section showing altitude flight path.

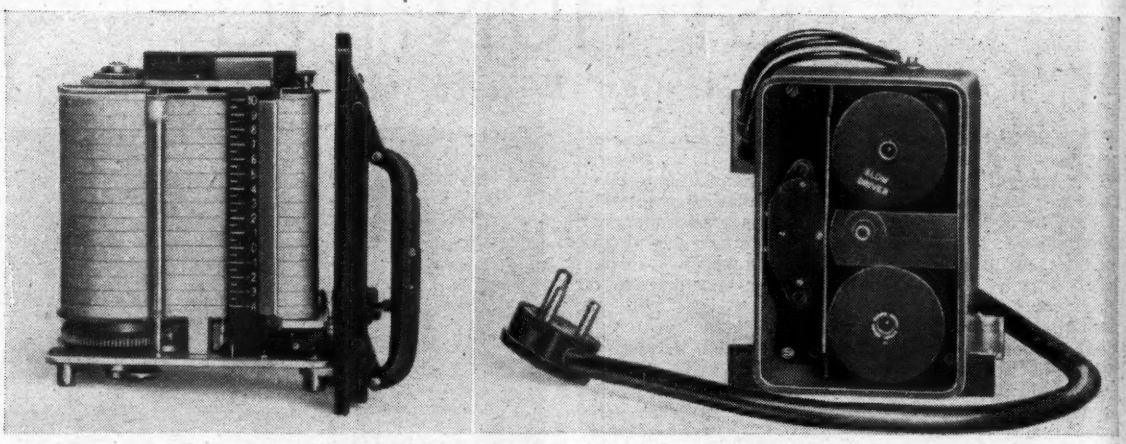
Equipment

In June, 1947, two P.R.34 Mosquitoes (Merlin 114As) were allocated on loan to the G.R.U. by the Ministry of Supply—it was considered that two aircraft were required to keep one flight crew fully occupied—and the aircraft were then sent to T.R.E., Defford, where they were equipped with T.R. 1430 V.H.F. R/T; S.C.R. 274 W/T; R 1598/99 C.B.A.; and A.R.I. 5083 Gee Mk II. After a sojcurn at Farnborough, where they underwent equipment testing, etc., the Mosquitoes were delivered to Cranfield in September, last year. On arrival at the G.R.U., Barnes and Peravia recording accelerometers, balance-bridge thermometers, V.G. recorders and fuel flowmeters were installed, and the aircraft were then put up for C. of A. in category G (i.e., the special category for aircraft engaged on experimental work). Unfortunately, the spares difficulty held up C. of A. clearance for some time, and it was not until March 1st that the first Mosquito, G-AJZE, was granted its C. of A., and not until June 3rd that G-AJZF, the second machine, received final clearance. However, between the aircraft acceptance tests made at Cranfield on January 22nd and the full clearance on March 1st, a number of flights were made under special permit but, of course, it was not until full C. of A. clearance was obtained that the research flight programme really started.

The work of the Gust Research Unit at Cranfield is in the active charge of Dr. G. S. Hislop, Ph.D., B.Sc.,

"Flight" photograph.

Dr. G. S. Hislop (left) is in overall charge of the B.E.A. Gust Research Unit, whilst Mr. D. M. Davies is the Scientific Officer based at Cranfield.



The recording accelerometers installed in the aircraft are the Peravia (left) low-speed unit covering a + 10 to — 4 g range, and the Barnes high/low-speed unit covering a range of ± 5 g.

Gust Hunting . . . . .

A.M.I.Mech.E., A.F.R.Ae.S., who is assistant to Mr. N. E. Rowe; whilst actually based at Cranfield are Mr. D. M. Davies, M.A., the scientific officer, Captain T. T. Thomas, D.F.C. and Bar, F.R.Met.S., research pilot, and Navigation Officer D. L. Jones. For six years during the war, Dr. Hislop was in charge of the high-altitude flight, and from there went to R.A.E., Farnborough, for two years, prior to joining B.E.A. in January, 1947. Mr. Davies went direct from Cambridge to the Performance Department of M.A.P., in 1942, where most of his time was concerned with high-speed fighters; he joined B.E.A. in June, 1946. Both Captain Thomas and Navigation Officer Jones gained a great deal of experience on Mosquitoes during their war service in the R.A.F., Capt. Thomas having served in the Pathfinder Force, whilst N/O. Jones was engaged on P.R. work with Mosquito 16s and 34s.

The task facing the Gust Research Unit has something of the needle-in-a-haystack quality, in that there is no factual evidence available anywhere to show why clear-air gusts occur, how frequently they occur, at what heights such gusts are most markedly violent, the amplitude of gust velocities likely to be met, nor whether the gusts are a function of terrain conformation, a result of particular meteorological conditions, or a complex of both. Although, therefore, there is some justification for the needle-in-a-haystack analogy, if, for example, after a year's flying totalling 500 to 600 hours, few data on clear-air gusts are amassed, it will be a negative answer of some positive value.

It is entirely possible that a great deal of flying will be put in to get only a few results, but this would afford some indication that the incidence of gusts may not, after all, be of serious moment. It is, however, much too early as yet to hazard any ideas on the subject, and for the very reason that the whole business is so tenuous, there is a certain danger in being over-hasty in drawing conclusions without the amassing of as many fundamental data as possible.

So far, a total of about 120 flying hours has been compiled, some 84 of which have been on useful flights, that is to say, sorties during which positive gust results have been obtained. These positive results were gained on four occasions, viz., on a flight to Inverness, where gusts of 0.5 g were encountered at 18-19,000ft over the Cairngorms; on flights to Lisbon and back, when gusts of 0.3 g were found over the Brest Peninsula at 25-30,000ft, and also north of Luarca, off the coast of northern Spain at 30,000ft; and on a flight back from Copenhagen, when gusts of 0.3 g were encountered at about 32,000ft over Heligoland. The velocities of these gusts were respectively 11.4ft/sec in the instances of 0.3 g acceleration, and 19ft/sec for the 0.5 g acceleration, the gust velocity being calculated from the recorded acceleration, equated with wing loading, relative air density, alleviation factor, slope of lift curve and indicated air speed.

The Flight Plan

The flight plan adopted on search flights is to climb steadily on course at the aircraft's normal climbing speed up to maximum height, about 36,000ft, then descend at a constant I.A.S. of about 220 m.p.h. to 20,000ft, thereafter climbing again to maximum height, this process going on throughout the flight, with the maximum height increasing to about 40,000ft as the fuel load is decreased. The sketch map shows the flight track of the Cranfield/Lisbon sortie, together with a vertical section illustrating the altitude flight path. At each 5,000ft-interval of climb and descent, the Peravia recording accelerometer is run for about one minute to take sample conditions.

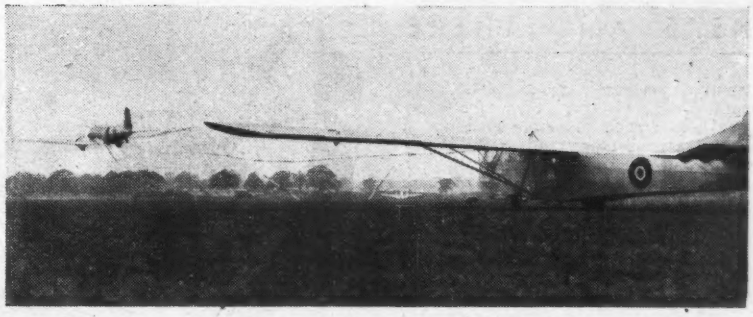
When gusts are encountered, the first thing Captain Thomas has to decide is whether, allowing, say, one hour for gust investigation, he can continue on to the planned destination, whether there is an alternative airfield which he could use if necessary, or whether it would be best to return to base. Having reached a decision on this, the first research requirement is to determine the thickness of the gust layer, and this is done by alternately diving and climbing through the layer several times. The second requirement is the taking of ambient temperature records at 1,000ft-intervals from 6,000ft below the gust layer up to 4,000ft above it, the temperatures being taken during short, level runs through the layer, so that figures are obtained of the ambients on each side of, and inside the layer, thus allowing a temperature gradient to be plotted. The next thing to determine is the horizontal extent of the layer, this being done by flying a form of square-search; the position-plotting of the gust region is fixed by Gee if it is in an area of Gee coverage, or otherwise by D.R. navigation.

Necessarily, the navigator's work must be of a sufficiently high standard to allow the precise fixture of the layer position, and it means 100 per cent concentration on navigation from take-off to landing, since gusts may well be encountered anywhere *en*

(*Continued on page 76.*)

Resplendent in the grey and red B.E.A. colours, Mosquito G-AJZE shares with its fellow, G-AJZF, the distinction of being the only aircraft of its type ever granted a full C. of A.

HERE AND THERE



SNATCH AND GRAB : A Dakota hooks a Hadrian glider from the ground at the Gatwick air pageant. As the hook engages with the cable attached to the glider, another cable pays out from a brake-loaded windlass in the Dakota. The poles holding the rope for pick-up can be seen falling apart.

Sir R. Dobson's R.Aux.A.F. Post

SIR ROY DOBSON, managing director of A. V. Roe, Ltd., has been appointed Honorary Air Commodore of No. 613 (City of Manchester) Squadron, Royal Auxiliary Air Force in succession to the late Lord Derby.

Theseus Still Going

THE "sealed" endurance test of the Bristol Theseus turboprop power unit, referred to in *Flight* July 8th, is approaching twice the target figure of 250 hours. As we go to press it is learned that the highly creditable time of 490 hours test running has been completed without any non-scheduled stop. If, as seems certain, the 500-hour mark is passed, a small celebration is to be held at Bristols.

Hawker Test Pilots

FOLLOWING the appointment of Mr. "Bill" Humble, previously chief test pilot of Hawker Aircraft, Ltd., to the position of sales manager, as reported in *Flight*, June 24th, Mr. T. S. Wade has been appointed chief test pilot; Mr. N. Duke, of Meteor High Speed Flight fame, has joined the Company as experimental test pilot.

Buyers' and Representatives' Association

FORMED about a year ago the Engineer Buyers' and Representatives' Association has now completed the laying of the foundations for the work which it intends to carry out, namely to elevate and uphold the status of engineer buyers and representatives, to ensure their fair and equitable treatment, and to make available to members contacts, information, ideas and suggestions which may prove helpful in their work. The offices of the Association are at 47, Victoria Street, London, S.W.1.

Vampires Leave for U.S.

THE six Vampires of No. 54 Squadron, details of whose forthcoming visit to America appeared in *Flight*, July 8th, took off from Stornoway on Monday, July 12th, on the first leg of the transatlantic flight. They have been help up by strong head winds for over a week and when they left were accompanied by two Mosquitoes and an A.S.R. Lancaster. The return visit of American Air Force Lockheed Shooting Star fighters to Britain has also been delayed and they will start when the Vampires arrive.

Fatigue in Flying

THE medical problems of flying were discussed at the B.M.A.'s annual conference at Cambridge, when papers were read to the Section of Occupational Health by Professor Sir Frederic Bartlett, F.R.S., and Air Marshal Sir Harold Whittingham, K.C.B., K.B.E. Professor Bartlett spoke on fatigue on flying, saying that under present conditions, deterioration of aircrew skill due to fatigue, did set in within the time range of many normal flights. The chief signs of the onset of normal fatigue in aircrews were ragged timing of operative movements, and a great prepossession with how the body is working, feelings of discomfort becoming more and more prominent; passengers on air flights were said to suffer more from boredom than fatigue, but the objective effects were much the same. Sir Harold Whittingham emphasized the importance of selection of aircrews and of the safety and comfort of both crews and passengers.

Racing Driver's Air Crash

WHEN returning from the recent Swiss Grand Prix motor race in Berne, one of the British competitors, Duncan Hamilton, piloting a Proctor V crashed into a hillside between Basle and Mulhouse. Both the occupants of the aircraft were unhurt, and after spending the night on the hilltop Mr. Hamilton was taken to Mulhouse by car and returned to England in an Air France machine. The Proctor flown by Mr. Hamilton, who served with the Fleet Air Arm during the war, was fitted with long-range tanks and made the outward flight from Blackbushe to Basle non-stop. Low cloud and bad visibility were contributary causes of the accident.

"EIN BITTER, BITTE."

Drink Charge Dismissed

A RECENT charge against Australian National Airways brought by the police for serving alcoholic drinks in the air without a licence, reported in *Flight* June 3rd, was dismissed by the magistrate who allowed costs against the informant. This followed the sale of beer to detectives in an A.N.A. aircraft over the State of Victoria. The magistrate declared that it was his opinion that the Commonwealth Government controlled the whole field of air navigation and the State licensing authorities had therefore no jurisdiction over an aircraft once it had left the ground.

College of Aeronautics Diplomas

THE following awards have been made at the conclusion of the two-year course 1946-48 at the College of Aeronautics. Specialisation is denoted in brackets: Diploma with Distinction: A. Lightbody, A. O. Ormerod, J. J. Spillman (Aerodynamics); J. H. Junter-Tod, R. J. Rackham, V. A. B. Rogers, J. Seddon, N. H. Wood, L. Wookey (Aircraft Design), W. E. Morris (Aircraft Propulsion). Diploma: D. C. Bain, P. F. Crawley, F. T. Davies, D. H. Earle, E. G. Havard, E. F. Lawlor, G. E. Preece, R. J. Ross, P. H. S. Wroe (Aerodynamics), H. B. Grant, R. A. Harriss, R. S. Hooper, D. K. R. Hopkins, P. G. Mobsby, A. J. Monk, L. S. D. Morley, L. W. Richards, M. R. A. Rizvi, P. A. L. Watson, A. A. J. Willitt (Aircraft Design), H. Caplan, P. J. Cooper, P. K. Hickman, W. S. Knowles, F. R. Spurrier, A. Stone (Propulsion).

Salvage Under Difficulties

A DIFFICULT salvage feat was recently carried out in the Southern Alps region of New Zealand when a Fox Moth from the Marlborough Aero Club, Blenheim, slightly damaged on landing, was blown over a 150ft cliff. Scene of the accident was Bluff station, a sheep run situated some 3,900ft above sea-level, which, until an air strip was laid down there in 1947, used to be isolated for five months of the year. The

HERE AND THERE

damaged machine was completely dismantled and brought down mostly by pack horse; parts too large to be taken down the pack horse trail to the valley below had to be manhandled by the salvage team, necessitating, in the case of the cockpit, a haul over a 700ft slope.

Dunlop Popularity

AT the recent annual general meeting of the Dunlop Rubber Co., Ltd., Sir George Beharrell declared that Dunlop wheels, tyres and brakes were now fitted to almost every new type of British aircraft. Pneumatic accessories for the operation of power plant and airframe controls and flame-proof hose, he added, are used by a large number of British aircraft constructors and operators and also by an increasing number of customers abroad.

Self-marking Target

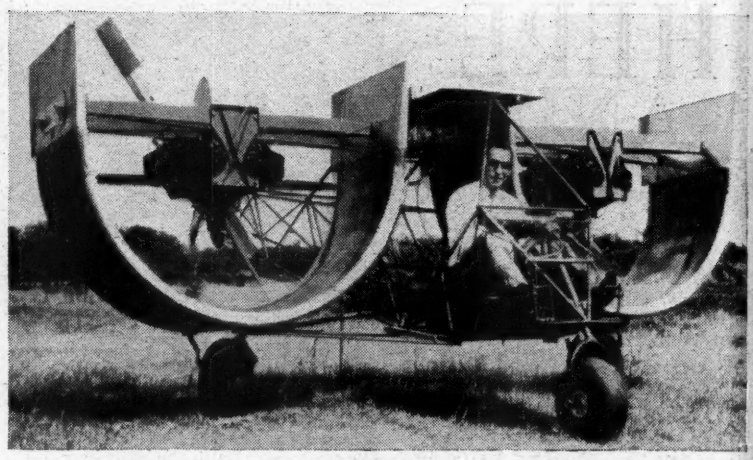
FIGHTER pilots practising air gunnery will now be able to learn the results of each shot whilst they are actually firing, by means of a self-marking target invented by Saab. Known as the Hit Indicator BT-13, this target is primarily intended for towing by aircraft. Attached to the target is a transmitter, shaped like a bomb, which transmits sound impulses caused by shots hitting the target back to the towing machine, where they can be read off and the results radioed in turn to the pilot of the attacking machine.

Flying-boats Have a Future

FOLLOWING a visit to the Belfast factory of Short Brothers and Harland Ltd., the Parliamentary Secretary to the Ministry of Supply, Mr. J. Freeman, said that in his personal opinion flying-boats have a very considerable future and he did not think Short Brothers and Harland would have any great difficulty in selling to the rest of the world types of aircraft produced at their works. Some of the aircraft produced and which were seen by the Minister include the Seal and Amphibian, the Sunderland conversion, the Sandringham, the Solent and the Shetland. On the Service side machines include the Sturgeon 1 and 2, and the Sunderland 5.

Northern Air Display

SPONSORED by the City and County of Newcastle-upon-Tyne, an air display is to be held at Newcastle Airport, Woolsington, on Sunday, July 18th. The theme of the display will be the development of air transport, both passenger and freight, and the sponsors hope enough support will be forthcoming to provide a static exhibition in addition to the usual display features. Leading interests in the aircraft industry have been approached, and the airport manager, Mr. P. K. Campbell, has also asked the R.A.F. to co-operate.



MILD AND BITTER: According to the inventor of this strange machine, Mr. Willard R. Custer, it has made a number of brief flights with Mr. Frank D. Kelley, of Hagerstown, Maryland, U.S.A., president of the National Aircraft Corporation, at the controls. One is apt to wonder how the "Custer Channel Wings," resembling halves of barrels, provide sufficient lift for sustained flight!

New Book on Metallurgy

IN order to modernize and combine their two former books *Molybdenum in Steel* and *Molybdenum in Cast Iron*, the Climax Molybdenum Company of Europe, Limited, are preparing a new volume which is to be distributed without charge to those interested. It is entitled *Molybdenum: Steels, Irons, Alloys*, and intending recipients are invited to approach the company at 2 and 3, Crosby Square, London, E.C.3.

Constellations and Cosmics

REGULAR consignments of nuclear emulsion plates are now being flown from London to Sydney by arrangement between the University of Melbourne and Qantas Empire Airways The plates are used in connection with the study of cosmic ray activity and are stowed in suitable positions in the Constellations. On arrival in Sydney the plates, which will have recorded the track of cosmic rays at high altitude *en route*, are transhipped to Melbourne University for processing.

South African Post

MR. J. W. P. ANGELL has resigned his post as repair and service manager at Miles Aircraft, Ltd., and has joined de Havillands as technical and service manager of their South African Company. He expects to leave for Johannesburg about July 20th.

News in Brief

A Bell helicopter, piloted by Capt. J. Youell recently landed on the roof of the seven-storeyed shop of Galeries Lafayette, in Paris, after a flight from Folkestone.

* * *

Russian model aircraft designer Mikhail Vassilchenko has claimed a new international distance record for a hydroplane flight of 22½ miles.

* * *

The wreckage of an aircraft located near Monto, Queensland, has been identified as an American transport aircraft reported missing between Rockhampton and Brisbane in November, 1943. There were seven Australians and five Americans on board at the time.

* * *

The experimental rocket range in Central Australia, some 230 miles north of Adelaide, has been declared a prohibited area for aircraft except with the permission of the Superintendent of the Long Range Weapon Establishment.

* * *

The Graviner Manufacturing Co., Ltd., announce that their aircraft equipment division, under the direction of G/C. Horniman, has moved from 53a, Pall Mall, and as from July 5th the new address will be Poyle Mill Works, Colnbrook, Bucks.

* * *

The Committee of the Royal Aero Club have decided to invite donations, limited to one pound, towards a portrait of the late secretary-general of the R.Ae.C., Lt. Cdr. H. E. Perrin, whose death on April 9th was announced in *Flight*, April 15th. Capt. E. Newling has been commissioned to paint the portrait from a photograph of Lt. Cdr. Perrin.

* * *

When asked in Parliament by Mr. Platts-Mills if he would invite the appropriate U.S. authorities to supply him with details of the XS-I supersonic rocket aircraft in order that the power system could be adapted for use in British aircraft, the Minister of Supply, Mr. G. R. Strauss, said that it was not in the public interest to answer that question.

PRIMER PERFORMANCE

THE following are the latest performance and weight figures for the Fairey Primer *ab initio* trainer, determined in maker's trials and at Boscombe Down:—

145 h.p. D.H. GIPSY MAJOR 10	
Weight empty	1,360 lb
All-up weight	1,960 lb
Wing loading	11.8 lb/sq ft
Power loading	13.5 lb/h.p.
Max. speed (s.l.)	134 m.p.h.
Cruising at 2,300 r.p.m.	122 m.p.h.
Min. speed (without flaps)	57 m.p.h.
Min. speed (with flaps)	51 m.p.h.
Climb (s.l.)	900 ft/min
Absolute ceiling	19,500ft
Service ceiling	17,300ft
Cruising range	383 miles

155 h.p. BLACKBURN CIRRUS MAJOR III	
Weight empty	1,360 lb
All-up weight	1,960 lb
Wing loading	11.8 lb/sq ft
Power loading	12.65 lb/h.p.
Max. speed (s.l.)	141 m.p.h.
Cruising at 2,200 r.p.m.	125 m.p.h.
Min. speed (without flaps)	57 m.p.h.
Min. speed (with flaps)	51 m.p.h.
Climb (s.l.)	940 ft/min
Absolute ceiling	18,800ft
Service ceiling	16,800ft
Cruising range	376 miles

CIVIL AVIATION NEWS

Research at Short's : Meteorological Discussions : U.S. and U.K. Airline Regularity Compared

ASIATIC JUNCTION : A B.O.A.C. Avro Lancastrian at Karachi. The Corporation still flies this type on a weekly service from London to Ceylon. The route is through Tripoli, Cairo, Basrah, Karachi—where a night's stop is made—and Bombay, arriving at Colombo 42 hrs. 10 mins. after leaving London.

DC-6 FREIGHTER

FROM the basic design of the DC-6 the Douglas Aircraft Company have developed a cargo aircraft the prototype of which is expected to fly next spring. It will be known as the DC-6 Air Freighter. Range is estimated at 2,000 miles carrying a payload of 15 tons—approximately the amount carried in two Skymasters. Operating costs have already been suggested and something like 5 cents or 3d per ton-mile is mentioned. Although the cost of the aircraft has not been announced, Douglas expect it not to exceed £250,000. The new aircraft will have similar dimensions to the DC-6, with a wing span of 117 ft 6 in, but with a fuselage 5 ft longer than that of the passenger version making it 105 ft 7in. Engines will be four Pratt and Whitney double Wasps each developing 2,400 h.p. with water injection. The 5,000 cu ft available for freight will be in a cabin fully pressurized and air conditioned.

NEW RESEARCH SECTION

ADVANTAGE has been taken by Short Brothers and Harland Limited, of the transfer of equipment and personnel from Rochester to Belfast to augment their facilities for research and for testing materials. A new building has been constructed in which complete sections of aircraft, such as wings and fuselages, can be tested. Provision has also been made for making vibration tests, or tests involving the use of petrol in a special vibration laboratory. Special attention has been paid to check-tests on steel and non-ferrous metals used in aircraft as well as to research work on new materials as they become available. Three types of universal testing machines giving a range from 500 lb to 15 tons in tension and compression have been installed. Nine special machines enable hardness testing to be made, and heat-treatment facilities include muffle furnaces, salt baths, and a low-temperature oven. Other equipment includes a Metropolitan Vickers crack detector and a Siemens Schuchert X-ray plant.

Of particular interest is the electronic section which is fully equipped to deal with strain measurements in the laboratory and on aircraft in flight. The readings of about 200 strain gauges installed in the laboratory can be recorded automatically in two minutes. Resonance testing, in which the complete aircraft is subjected to pre-determined vibration to simulate conditions which are met in flight, and in which the amplitude and phase relationship of the motion of the whole aircraft can be examined, has been included in order to study cabin noise and so increase passenger comfort. A wind tunnel built from pre-fabricated steel has a maximum air speed across the working section of 188 m.p.h. There is also an instrument section responsible for the calibration of all important instruments, and a fully equipped dark room to cater for all photographic needs. The engineering shop is equipped to manufacture any specimens required by the department for research, and the model shop can produce models of high accuracy for wind tunnel purposes. Models have been built with 12 ft wing span and having fuselages 10 ft in length.

Layout of the new research department is compact, and the reinforced floor space covers 200ft by 90ft with 30ft minimum head room height.

TRAVEL FILM SHOWS

FOR the benefit of overseas visitors, daily film shows are being presented by the Travel Association, Tourist Division of the British Tourist and Holidays Board at the the Tourist Information Centre, Leicester Square, London. They are intended to give tourists in London a preview of those places they may intend to visit during their stay, and are produced under the general title of "Travelling Around." The films are intended primarily for distribution overseas and are at present being shown in 17 countries. The Information Centre in London was established for the particular benefit of visitors from overseas and already several hundred enquiries are made daily. There is a reception room and light refreshments can be obtained.

A breakdown of the passenger traffic into the U.K. this year is not available, but it is estimated by the Travel Association from figures issued by the American Civil Aeronautics Board that 20 per cent of arrivals from the United States are by air. The Association estimate that broadly speaking the same percentage applies to travellers from other places overseas.

B.E.A. IN SCOTLAND

FIGURES for B.E.A. services in Scotland for May this year offer direct comparison with the corresponding month in 1947, since it was not until April 12th, 1947, that the last private company, Allied Airways (Gandar Dower, Limited) was absorbed into the Corporation. During the month 239,209 miles were flown compared with 225,140 in 1947. Nine thousand seven hundred and twenty-six passengers and 158,781 lb of freight were carried, compared with 8,682 passengers and 101,269 lb of freight for the previous year. During the year ending May 31st, 1948, 125,699 passengers and 1,481,563 lb of freight, mail and excess baggage were carried, and the miles flown were 2,929,986.

AIRFIELD ADMINISTRATOR

TWO M.C.A. appointments, those of Controller of Technical and Operational Services and Controller of Aerodromes, have been combined into one, the occupant of which will be known as Controller of Ground Services. He will have the rank of Deputy Secretary with a salary of £2,500. The object of the change is to bring under one departmental head those functions

Civil Aviation News . . . .

2330 hr on Sundays has been established. The service includes import and export customs clearance, collection, delivery and forwarding

* * *

After holding out for over a month A.N.A. is to reduce fares on the Sydney-Brisbane, Sydney-Melbourne and Sydney-Tasmanian air routes to the same level as charged by T.A.A. and Ansett Airways. Commenting on the decision, Capt. Ivan Holyman, managing director of A.N.A., said that it had been made with the full realization that the fares being charged by Australian airlines were uneconomical and not in the best interests of the country, but his company must meet the "unfair competition" of T.A.A., made possible by the expenditure of public money. Mr. Holyman also referred to the £350,000 payment being made to T.A.A. for the carriage of mails which was, he said, a much higher rate than was paid to A.N.A. when that company ran a similar service.

FROM THE CLUBS

THE Broxbourne breakfast patrol will be held by the Herts and Essex Aero Club on Sunday, July 18th, between 9 and 9.30 a.m. The height will be between 1,000 and 2,000 feet and the defence zone will be the area between two and five miles from the centre of the airfield. A special prize will be awarded to the pilot landing nearest to a sealed time.

* * *

Private ownership within the Derby Club is rapidly growing, new machines including Mr. Gadsby's Auster, Mr. John Green's Magister, Mr. Martin Neaum's Messenger and Mr. and Mrs. Ratcliffe's Autocrat, which was bought to celebrate their first solos. Among those who recently qualified for their "A" licence are Mr. Peter Rudge, Mr. Arthur Deakin, Mr. Peter Walter and Mr Maurice Beaumont. The Shell-Mex film "How an Aeroplane Flies" was shown recently and Derby strongly recommend it to other clubs who have ciné facilities.

* * *

Among the numerous Continental air rallies to be held this summer are those organized by the Aero Club of Villefranche-en-Beaujolais which will take place on July 17th-18th, and by the Aero Club d'Orange which is planned for July 31st, August 1st and 2nd. The Aero Club of Milan will be running a similar event at the Forlanini airfield, Milan, on September 18th and 19th. Entry forms and details of the rally at Orange, which lies about 15 miles to the north of Avignon, on the east bank of the Rhone, can be obtained from the Royal Aero Club Aviation Centre, Londonderry House, Park Lane, London, W 1. One of the main events at Milan will be the grand prix race for which regulations and entry forms can also be obtained from Londonderry House.

* * *

The Gloucester Flying Club held their annual "At Home" and flying display at Staverton airfield on Saturday, July 3rd. The programme started with a mock bombing display by F/O. Burgess and Mr. R. Law flying a Tiger Moth; their target was Mr. J. Anning riding a Corgi motor cycle. Unfortunately, during one of the bombing runs Mr. Anning was struck on the head and had to be removed to hospital. Mr. Bernard Lynch's parachute descent ended in an orchard, and whilst he was not injured, his parachute was only with difficulty extricated from the branches of a tree. A display of aerobatics by a Vampire, formation flying by five Harvards and demonstrations by a Lancaster and a Spitfire followed. The day closed with a race for visitors, which was won by an Autocrat flown by Mr. Plank, Miss Chapman, of Hereford, coming a close second in a Tiger Moth.

* * *

The London Aeroplane Club regret to announce that, owing to the support of certain authorities being withdrawn, they have been obliged to cancel their garden party which was to have been held on August 14th.

* * *

The Leicestershire Aero Club's "At Home," at Ratcliffe airfield on July 4th, was somewhat spoilt by bad weather, low cloud and driving rain sometimes reducing visibility to a few hundred yards. Despite this, however, 19 aircraft—all club and private machines—turned up to see the reduced but still spectacular flying display, and compete in the events. Four Austers took part in a low-level race round a four-mile, triangular course on which three laps had to be completed. This was won by Mr. H. C. Rogers, C.F.I. of the Nottingham Flying Club, with Mr. Coltman second, F/L. B. V. Hewes, C.F.I. of the Leicestershire Aero Club was third, followed closely by S/L. John Stubbs. The time of arrival contest was won by Mr. K. F. Graham of the Nottingham Flying Club.

* * *

Owing to petrol restrictions and the fact that the Royal Aero Club are not sponsoring any air racing this year it has been decided by the Southend Municipal Flying School not to hold an international rally and race meeting. Instead a club "At Home" is being organized, the programme for which will include an arrival patrol, spot landing competition, bombing competition, balloon-bursting contest, and an aerobatic display. School aircraft will take part in a race at 1800 hours; the programme is scheduled to start at 14.45 hours and finish at 18.30 hours, and the date appointed is Saturday, July 17th.

* * *

The Wiltshire School of Flying have published details of the Thruxton Air Races which are due to take place on August 21st, beginning at 2 p.m. The programme will begin with a time of arrival competition between 1.30 and 2 p.m., after this there will be a pin-pointing competition over a triangular course of approximately 30 miles, followed by a one-class race for Auster Autocrats over a triangular course of three laps totalling approximately 10 miles. At 4.30 p.m. there is to be a one-class race for Auster 1s and 2s open to all visiting aircraft over about 10 miles. This will be followed by another one-class race, this time for Magisters, over the same distance. The last race will be an open handicap race for all types, run over a course from Thruxton to Cowes and back to Thruxton, a distance of about 70 miles. The programme will finish with height judging and speed judging contests and prizes will be awarded for the best turned-out aircraft and the best turned-out passenger. Entries should reach the Secretary, Race Committee, c/o the Wiltshire School of Flying, Ltd., Thruxton Aerodrome, near Andover, Hants, not later than August 19th.

"Flight" photograph

A very interesting and representative selection of privately owned aircraft were to be seen at Deauville. At least six different types can be distinguished in this photograph.

DESCENT ON DEAUVILLE

(*Continued from page 77*)

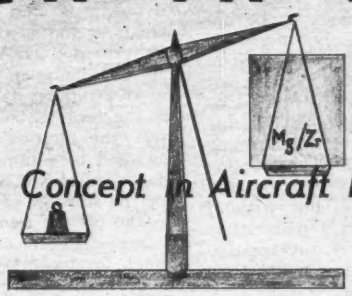
on the hill overlooking the resort, and on this occasion the visitors were welcomed by M. Julien Duclos, Director of the Société des Hotels.

A surprise for all was the arrival from Paris of Capt. Jimmy Youell in the Bell helicopter, which landed on the fairway outside the Golf Hotel. Capt. Youell, after lunch, transported Mme. Jacqueline Duclos by helicopter to the Royal Hotel lawn, and then took Commandant Hurel to the airfield. A characteristically charming and generous gesture on the occasion of the final ball at the Casino on Sunday evening was the presentation of perfume to all ladies.

The thanks of all who took part in the excellent rally are due also to the Aero Club organizers, Colonel Preston and Mr. Duncan de la Hoyde, and, incidentally, to the Shell-B.P. Aviation Service, for the attractive and useful map folder.

DESIGN IN LOGIC

THE PLANET SATELLITE



Full Details of a New Concept in Aircraft Design and Construction

IT is all too rarely that we are given the opportunity to analyse something utterly new, so that when such an event does come our way we are inclined not only to welcome it on the appealing score of novelty, but also to give it particularly careful attention. Hastily drawn conclusions do no one any good, and, in dealing with the unfamiliar, as anything completely fresh must be, we deem it advisable to err on the side of caution in making an evaluation, despite the, perhaps, facile attractiveness of initial impressions. Having made clear the basis of our approach, we may now go on to consider the object of our unfamiliarity, a startling new design by Planet Aircraft, Ltd., which has been named the Satellite.

First of all, we ought, perhaps, to consider the background of thought which led to the creation of the machine. Major J. N. D. Heenan, of Heenan, Winn and Steel, consulting engineers, 29, Clarges Street, London, W.1, is the man responsible for the Satellite. It is the first aircraft which he has designed, but, as he himself says, had he ever designed an orthodox aircraft, preconceived ideas would have so trammelled his outlook that the concept of such a design as the Satellite would have been virtually impossible; an argument with which we are inclined to agree.

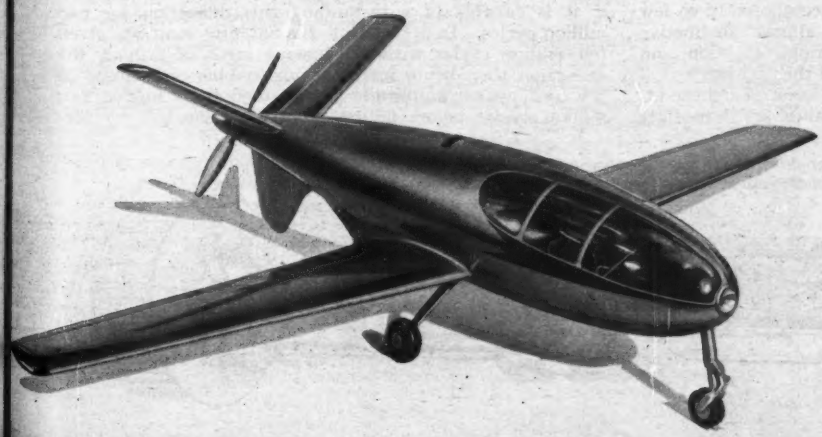
During a stay in the U.S.A., Major Heenan found the consensus of opinion agreed that a four-seater aircraft would fulfil the demands of 60 per cent of the potential market if the machine could be built at a reasonable price, and he reasoned that the development of such aircraft would most likely follow a similar trend to that taken by the motor car, which could be said to have become standardized as a 4-5-seater with ample baggage space, good visibility and silence. He also reasoned that the main sales for an aircraft of this size category would be outside England, in places where surface transport was relatively poor and the distances relatively great. Having postulated the requirements of price, comfort and relative silence, it went without saying that the aircraft should be safe, fast and economical in operation and upkeep.

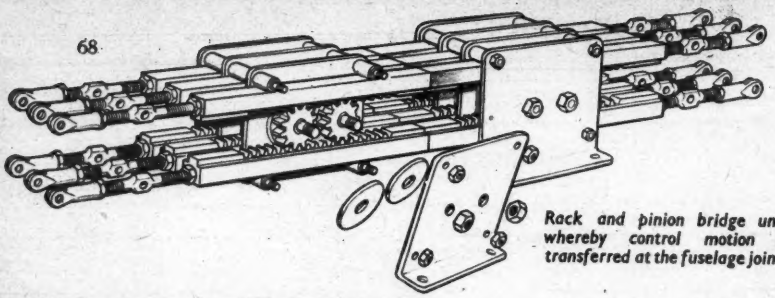
Reasons for Heterodoxy

It was the desiderata of low price and low noise level as much as anything which introduced the radical into Major Heenan's concept, for he concluded that to get down to a reasonable price, the design of the aircraft would have to be entirely different; with orthodox designs, aircraft could never be produced cheaply except in very large quantities, and there were few possibilities of vast quantities of aircraft being sold. On the score of noise, as about half the noise volume is produced by the airscrew, he decided that the best way to reduce noise level in the cabin was to separate airscrew and cabin by as great a distance as possible. Further, if the engine were to be placed behind the cabin, a good sound-proof bulkhead could be interposed between them, and a silenced exhaust arranged to discharge below the fuselage. The quality of safety made essential a lowish stalling speed and a moderate wing loading allied with generous flaps and effective brakes. Economy of operation and an attractive speed performance impelled keeping drag down to a minimum.

From these musings, the geography of a design took shape in the designer's mind. Then came

The distinct attraction of the Satellite's unfamiliar appearance is made apparent in this model.





Rack and pinion bridge unit whereby control motion is transferred at the fuselage joint.

DESIGN IN LOGIC . . .

considerations of construction. Cheapness appeared to Major Heenan to be attainable only by reduction of the number of parts, and it was when considering this aspect that he recollected the classic lobster-claw construction. A lobster's claw is an example of pure monocoque structure; that is to say, the skin is sufficiently strong and sufficiently thick to take all the strains likely to be imposed upon it without requiring internal bracing members. Although the term monocoque is universally employed in relation to conventional aircraft construction, this is not really justified, since the accepted practice is to use as thin a skin as possible, supported on an internal bracing of frames and stringers, the complete fabrication forming a stress-bearing whole. Pure monocoque construction could only be made practicable for aircraft if a material very considerably lighter than aluminium, but without sacrifice of strength, were available. Such a material, a new alloy called magnesium-zirconium, fulfils this requirement; it has a relative density some 40 per cent less than that of aluminium.

Prejudices Confounded

Magnesium has been known to aeronautical engineers for a long, long time, but has always suffered prejudice on the twin scores of fire hazard and corrosion. When looking into the fire problem, Major Heenan found that magnesium does not burn readily; the thermal conductivity is so good that, unless the metal is completely enveloped, the heat is dissipated so rapidly through the metal that combustion is not supported.

As for corrosion, pure magnesium is virtually inert to the action of salt water, but if traces of impurities are present, such as nickel or iron, then electrolytic action will cause corrosion of the magnesium. Modern magnesium alloys, however, are of high purity, and the rate of corrosion, even in salt water, is not sufficient to incur trouble in aircraft. Protective treatments, such as chromating, are completely satisfactory, and much evidence has been amassed to show that, with the normal precautions taken by chromating and painting (such as would be applied with any material) the question of corrosion simply does not arise.

Despite some initial preparation of what to expect "in the flesh," one's first reaction on examination of the prototype Satellite, now nearing completion, is one of uneasy astonishment at the lack of structural odds and ends. Never before have we seen an aircraft composed of so few corporate parts. Suppressing one's almost instinctive hankering for the familiar frame-and-stringer skeleton, and continually running over in one's mind the incisive logical arguments for this unusual structural form, the sheer attraction of the Satellite's layout makes an immediate mental appeal, chiefly perhaps owing to its essential rightness.

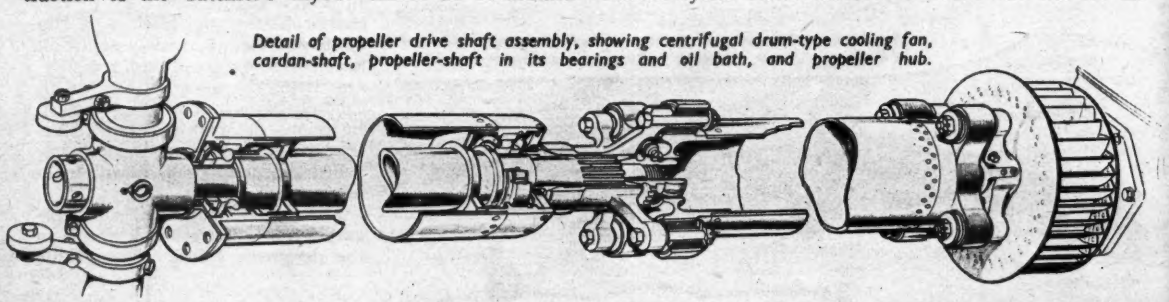
The fuselage is an undebased solid of revolution, with a fineness ratio of 5.63, the maximum diameter occurring at 34.3 per cent chord. The profile was determined quite simply. The maximum diameter (56in) is at the firewall dividing cabin and engine compartment, and the lines of the forebody were settled by the contours of the front screen. This is of a shape which, it has been established, will remain clear even in dense rain, the contours being such that raindrops are blown away immediately they form. The afterbody of the fuselage is a simple, straight-sided cone, running to a finishing point formed by the propeller spinner. The nose compartment of the cabin is given over to the nosewheel well, flanked at each side by the leg recesses for the occupants of the front seats. A "roof" to this is formed by the scuttle tray, at the rear end of which is the instrument panel and facia. Squabs only are provided both for the front and rear seats, the seat cushions being laid direct on the cabin floor, although this is so arranged as to give foot wells for the passengers in the rear seats. The engine is carried almost directly over the aircraft's centre of gravity and is completely enclosed in a firewall-bounded compartment, to port and starboard of which are surprisingly large volumes (17 cu ft) for the stowage of luggage. Drive from the engine is given to the 6ft 6in two-blade Aeromatic v.p. airscrew through a large-diameter cardan-shaft of extruded magnesium. So much for basic layout.

Beyond stating that the Satellite is so clean aerodynamically that it almost justifies the term hygienic, this aspect of the design may be left to the photographs for emphasis. Certainly, it is on the aerodynamic side of the design that the Satellite's future may be said to rest, for the successful acceptance by the aeronautical world of the precepts of which this aircraft is the embodiment, at the moment rests solely on its performance in the flight trials. We use the term "solely" because it has already been physically established that an aircraft can be built of magnesium throughout and, furthermore, that the pure monocoque form of structure—for so long a classic theory seemingly unattainable in earthy practice—is, in fact, demonstrably possible.

Strength Confirmation by N.P.L.

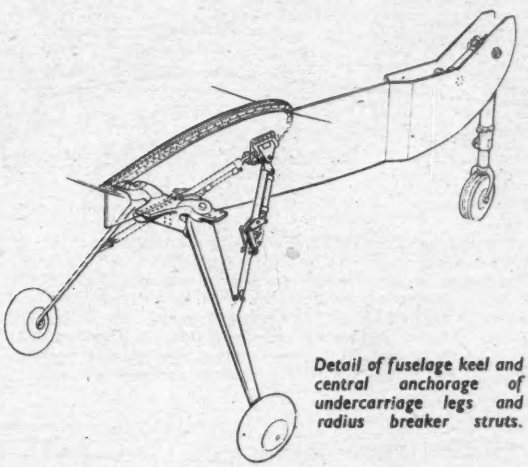
Fears on the grounds of structural weakness are best answered by the results of tests in static bending, dynamic bending and torsion executed at the Engineering Division of the National Physical Laboratory. Briefly, the results of these tests can be summarized as follows: the wing ultimately failed under static load (sandbags) at an equivalent of approximately 190 lb/sq ft of wing surface, this being equivalent to a constant load of 10 g. The dynamic bending test imposed bending deflection equal to that imposed by 10 per cent of the maximum designed bending load of the wing. A wing design is considered to be good if it is capable of withstanding this deflection for two million cycles. In actual fact, the Satellite wing was given ten million cycles without showing signs of failure, the deflection then being increased up to plus and minus 40 per cent, which amplitude it withstood for a further two million cycles before failure occurred. The test for tor-

Detail of propeller drive shaft assembly, showing centrifugal drum-type cooling fan, cardan-shaft, propeller-shaft in its bearings and oil bath, and propeller hub.



sional stiffness provided a value of 10,300 lb ft per radian, which can be expressed as 30 lb ft per minute of arc. These figures make superfluous any further comment on the subject of structural strength: they are extremely impressive. We might, however, note a side issue concerned with the mechanical properties of magnesium. This material has an inherent quality of elasticity that has something of the same attributes as spring steel. This was exemplified in the torsional stiffness test, for when the failing load was released, the wing snapped back into place and the buckle which had appeared in the skin vanished, the only apparent result of the buckle being a slight kink in the leading edge. This is particularly important, since it establishes that even after the impost of some enormous structural load, the wing (or other part of the aircraft) would regain its basic shape and perform its duties virtually unimpaired.

Although the structure of the Satellite is simple almost to the point of absurdity, there are detail elements of the design which exemplify that quality of untrammelled logic which characterizes the whole aircraft, and it is with these that we shall chiefly concern ourselves, since the actual structural detail (what there is of it) is shown perfectly clearly by our perspective cut-away drawing. We have already referred to the physical shape of the forebody and afterbody of the fuselage, but the method of uniting these halves is well worthy of attention. The joint occurs at the

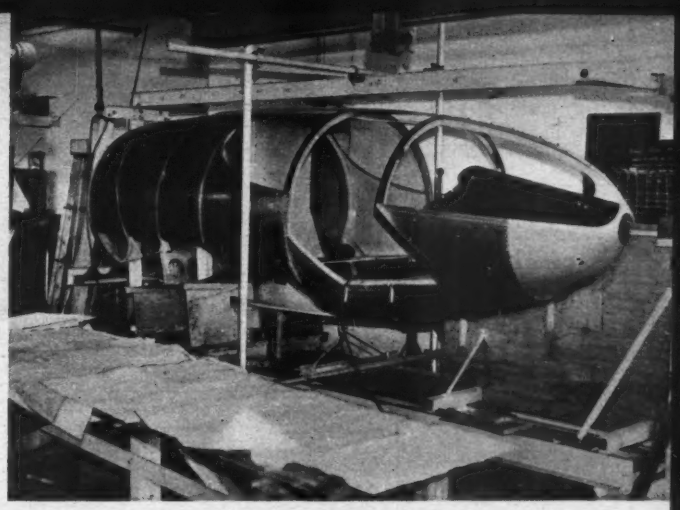


Detail of fuselage keel and central anchorage of undercarriage legs and radius breaker struts.

wing root trailing edge, and is made with two angle-section extruded rings, the free flanges of which are tapered and butt back-to-back, being locked together by the radial expansion of a channel-section split ring incorporating a trunk-type lock. Both angle-rings and the channel ring are machined magnesium extrusions.

The need for breaking the fuselage at this station is to afford complete access to the engine, although for all normal purposes of engine attention, ample accessibility is provided from the luggage space on each side of the engine compartment, and, by means of a removable top panel in the fuselage, to the various accessories mounted above the engine crankcase. As no direct lateral shear-connection is provided by the form of fuselage joint used, means have had to be embodied to cope with torsion loads in the fuselage imposed by control surface reaction and airscrew torque reaction. These are accommodated by a simple arrangement of ¼in dia. high-tensile steel spigots carried in the rearward portions of the wing root fillets, these registering in blocks incorporated in the forward portions of the fillets.

Necessarily, since the fuselage can be severed into disparate sections, means must be provided for equal severance in the control linkage between cockpit and tail surfaces. This problem has been solved in a most truly ingenious manner. Cable control runs are used, and, at the joint, a system of racks and pinions is used to transfer



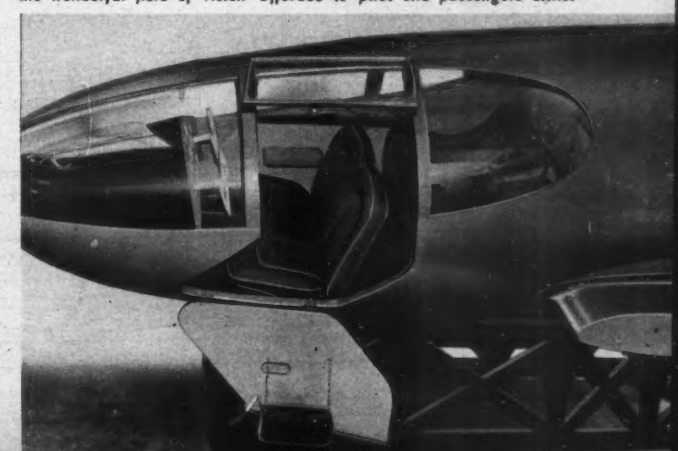
The Spartan simplicity of structure and ease of production can be readily appreciated from this view of the prototype in its jig.

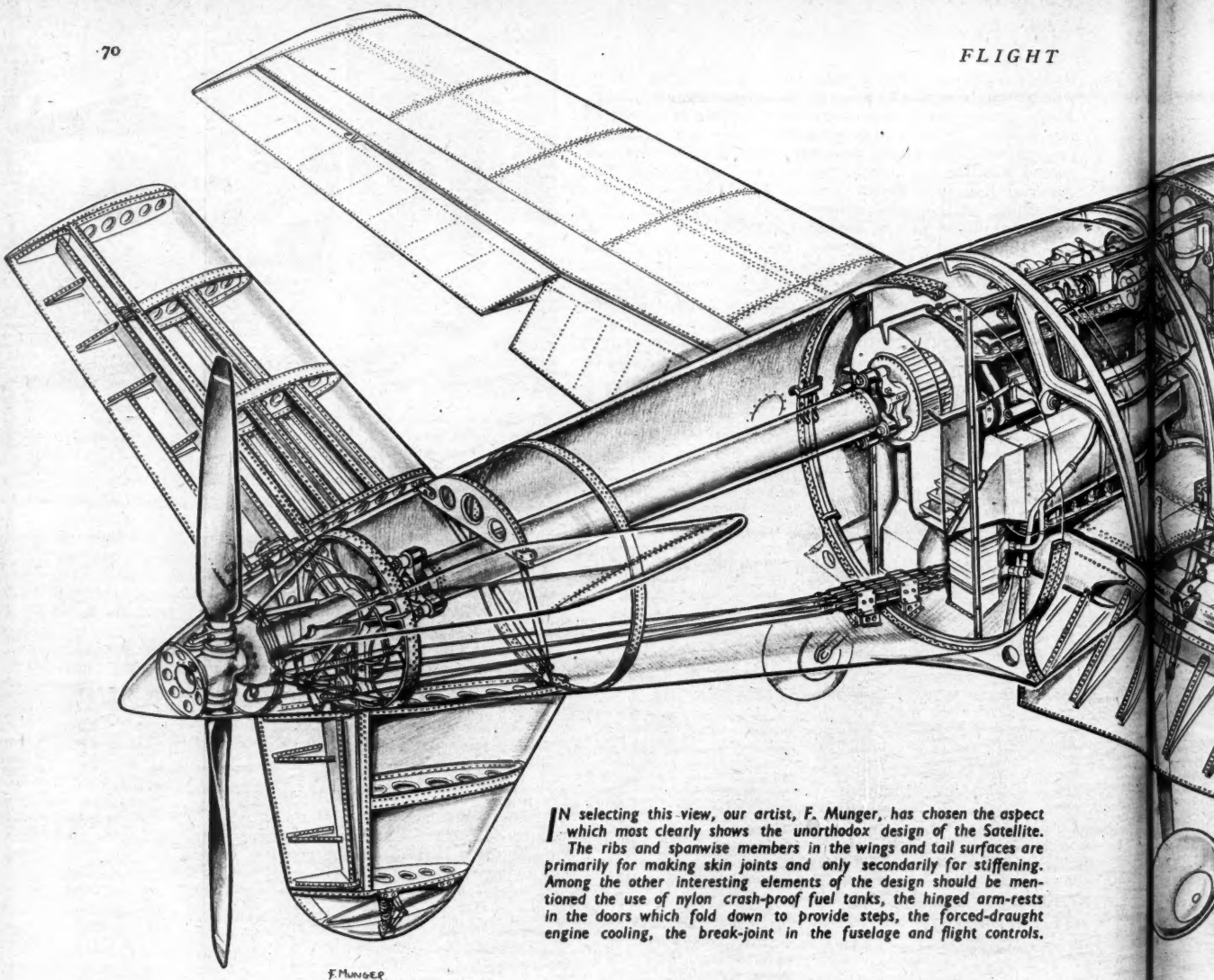
motion from the forward part of the fuselage to the rearward part. The control cables terminate in square-section racks meshing with common pinions and running against rollers carried on side plates. The ends of the forward racks butt against the ends of a precisely similar arrangement of racks on the rearward side of the joint. The action is that tension in, for example, an upper cable on the forward side of the joint, is transferred from the rack through the front pinions to the lower rack of the control return circuit. As the latter rack moves rearward, it pushes its complementary rack mounted in the rear fuselage, which motion is transferred through the rear pinions to the upper rack at the rear. Thus the joint is bridged by making use of the return circuit at that particular point. This, too, is a design detail which is more easily explained in illustration than in words.

Power Installation

The power installation of the Satellite is interesting not only by virtue of the transmission system used, but also from the aspects of engine housing, cooling and silencing. The engine is cush-mounted on rails in two cast magnesium horseshoe frames and is enclosed by firewalls on each side and at the front. Air is taken in through a simple, flush slot across the fuselage roof (shades of Prandtl), and surrounding the engine shaft is a drum-type centrifugal fan delivering through a volute scroll to the starboard side of the engine cylinders. A branch duct from the delivery volute serves the oil cooler, and "venetian blind" shutters in the main duct can be used to blank-off airflow when shutting down the engine or in the event of an engine fire. Having passed across the cylinders, the air is collected in a box on the port side of the engine, this box enclosing the induction manifolds and the exhaust manifold-cum-silencer, the latter discharging through a fish-tail, together with the cooling air, beneath the fuselage just forward

This view of the mock-up front fuselage gives a clear indication of the quality of comfort to be expected from the roomy seating layout and the wonderful field of vision afforded to pilot and passengers alike.





IN selecting this view, our artist, F. Munger, has chosen the aspect which most clearly shows the unorthodox design of the Satellite. The ribs and spanwise members in the wings and tail surfaces are primarily for making skin joints and only secondarily for stiffening. Among the other interesting elements of the design should be mentioned the use of nylon crash-proof fuel tanks, the hinged arm-rests in the doors which fold down to provide steps, the forced-draught engine cooling, the break-joint in the fuselage and flight controls.

DESIGN IN LOGIC . . .

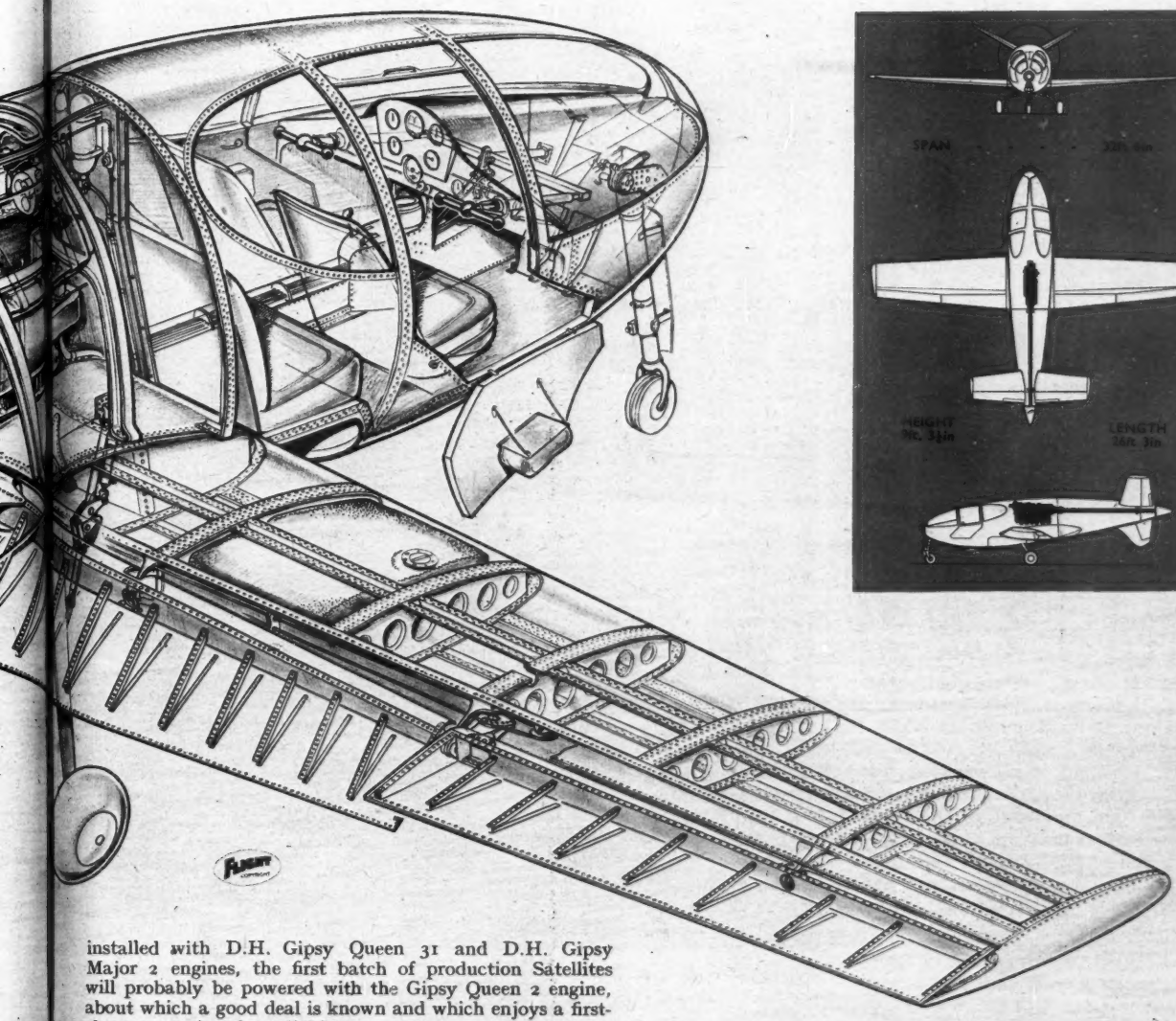
of the main joint. This system of fan-cooling should, it is calculated, permit prolonged running on the ground without incurring high cylinder-head temperatures, and, in addition, the use of an air-shrouded, silenced exhaust with a remote discharging point should provide a lower noise level for the cabin than, perhaps, ever before attained in a single-engined aircraft. Furthermore, it is calculated that the exhaust thrust obtained will compensate the cooling losses.

Transmission Details

The transmission system linking engine and propeller is neat and clever. The engine shaft is splined to a high-tensile steel four-armed spider retained on cone seatings by a nut, itself held to the spider by a cage. Around the periphery of this nut is cut a worm-rack, and a wormwheel is carried in one of the spider arms: this worm is mounted on a square-ended pin, and when turned by a brace and bit (through an access hole in the fuselage) the nut is caused to turn, to butt against the retaining cage, and so draw the spider off the engine shaft. The converse also applies, and, the worm being irreversible, built-in locking is, of course, embodied. High-tensile steel bolts through the spider arms engage Silentbloc rubber/metal bushes in the arms of the complementary spider carried at the forward end of the cardan shaft. The spider retaining/ extracting nut also has a spherical profile which registers in the bushed end of the cardan shaft to provide concentric location for the latter.

The cardan shaft is itself interesting in that it is a magnesium extrusion, machined to an outside diameter of 5in and machine-bored to give a wall thickness of 0.11in. The machining work was done at Woolwich Arsenal—the shaft is approximately 8ft long—and the weight, complete with spiders, is but 14 lb. At the rear end of the cardan shaft, a somewhat similar arrangement of spiders obtains, the "driven" spider being splined to the propeller shaft. This is carried in a journal roller bearing at its forward end and in a ball thrust bearing at its rear end, these bearings each being housed in the ends of an oil bath shroud enclosing the airscrew shaft. The forward end of the oil bath is housed in the bore of a cast magnesium, three-spoked ring, from the periphery of which a triangulated formation of six tubular struts carry a machined magnesium collar enclosing the rearward end of the oil bath. Gyroscopic couples, thrust and torque loads are taken by the strut triangulation and transferred into the fuselage cone. Incidentally, in the event of a crash landing, the engine would be restrained from moving forward into the cabin, since the cardan shaft is stressed for 26 g tensile load which would be resolved as compression in the fuselage cone. The bending load on the engine mounting frames would be slight.

Whilst concerned with the power unit side of the Satellite, we may mention that, although the intention is to make available high- and low-powered versions respectively



installed with D.H. Gipsy Queen 31 and D.H. Gipsy Major 2 engines, the first batch of production Satellites will probably be powered with the Gipsy Queen 2 engine, about which a good deal is known and which enjoys a first-class reputation for reliability.

We cannot leave the Satellite without giving some consideration to the singular effect on aeronautical engineering which is implicit in the successful prosecution of so revolutionary a concept. It is Major Heenan's calculation that, by the use of pure monocoque structure in magnesium-zirconium, the present norm of payload percentage could be doubled. That is to say, the current average payload of about 8 per cent of the aircraft's all-up weight could be increased to about 16 per cent.

No less important is the strategic aspect. In every cubic mile of sea water there are over four million tons of magnesium, and, by September, 1939, the process of extracting magnesium from sea water was well established in this country; by the end of the war, our production capacity of magnesium was nearly three thousand tons a month.

The advantages attendant upon eliminating the need for importing raw materials of high strategic value do not need amplification.

That an aircraft can be built of magnesium has been demonstrated, and, furthermore, that the structural strength of such an aircraft is enormously high whilst that structure remains almost fantastically light has been proven by the completely impartial tests conducted by the National Physical Laboratory.

PLANET SATELLITE

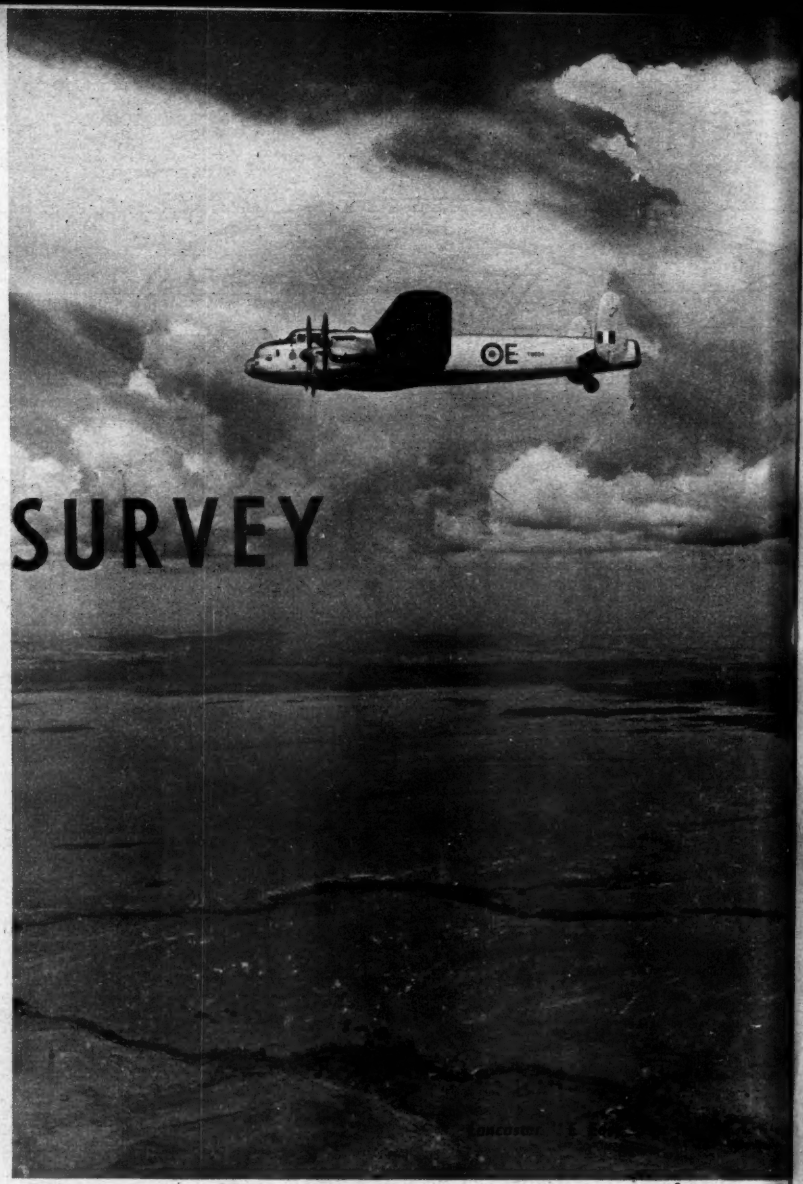
One D.H. Gipsy Queen 31, or Gipsy Major 10 engine Driving 6ft 6in Aeromatic v.p. propeller

Span	32ft 6in
Length	26ft 3in
Height	9ft 3½in
Wing area	153 sq ft
Aspect ratio	7.34
Aerofoil section	N.A.C.A. 23000 series
Gross weight	2,905 lb
Wing loading	19 lb/sq ft
Power loading (Gipsy Queen 31)	11.6 lb/h.p.
Payload	880 lb
Percentage structure weight	25.6

Estimated Performance
(Gipsy Queen 31)

Max T-O power	250 b.h.p.
Econ cruising power (max W.M.)	181 b.h.p.
Max S.L. speed	208 m.p.h.
Econ cruising speed (max W.M.)	191 m.p.h.
Stalling speed (max loading)	62 m.p.h.
Initial rate of climb (at max load)	1,450ft/min
Max range with full payload	1,000 miles
Max range with pilot only	2,450 miles
Absolute ceiling	22,000ft
T-O to clear 50ft	310 yds

The Lancasters of No. 82 Squadron at Work



AFRICAN SURVEY

FOR eighteen months past, No. 82 Squadron, R.A.F., which has its headquarters at Benson, in Oxfordshire, has been surveying tracts of East, West, Central and South Africa. The Squadron is stationed at Eastleigh, Nairobi, from which centre detachments are dispatched to outlying airfields in order to cut down the "dead" flying time to and from the centre of operations. Equipment consists of seven special Avro Lancasters, without armament, but with two K.17 cameras apiece, each magazine for which holds enough film for some 200 exposures. From 10,000ft with a 6-inch lens, a picture is taken electrically every thirty seconds, which means that each magazine lasts an hour and a half. As each camera has up to four magazines, and as up to an hour and a half's flying to the target may be necessary, a sortie may last as long as 9½ hours.

The pilot holds his aircraft straight and steady.

Technically, the most important consideration is the manner in which the Lancasters are controlled. At briefing (carried out by a special section of the Royal Engineers) a map showing the districts to be photographed is consulted, and the navigator decides how he will fly precisely over the lines required. Here radar comes to his aid. In the centre of a district an airfield or landing strip is picked out and the Dakota transport belonging to the Squadron is loaded up with a radar beacon, batteries, aerials, a large tent and shot guns. From the strip the party moves to the exact spot decided upon for the beacon and commence operations next morning.

With his GH receiver the navigator in the Lancaster, by watching the tube and giving instructions to the pilot, can navigate along a predetermined line with very great accuracy—within a matter of yards. The camera is set in motion as the aircraft arrives, and a run of overlapping pictures is obtained, showing a circular strip of land forming a circle with the beacon at the centre. A second run, a few hundred yards farther away from the beacon, adds a second strip, which overlaps the first. Each day more strips are added until a huge piece of territory surrounding the beacon has been photographed and the time arrives for the beacon to move to the next position.

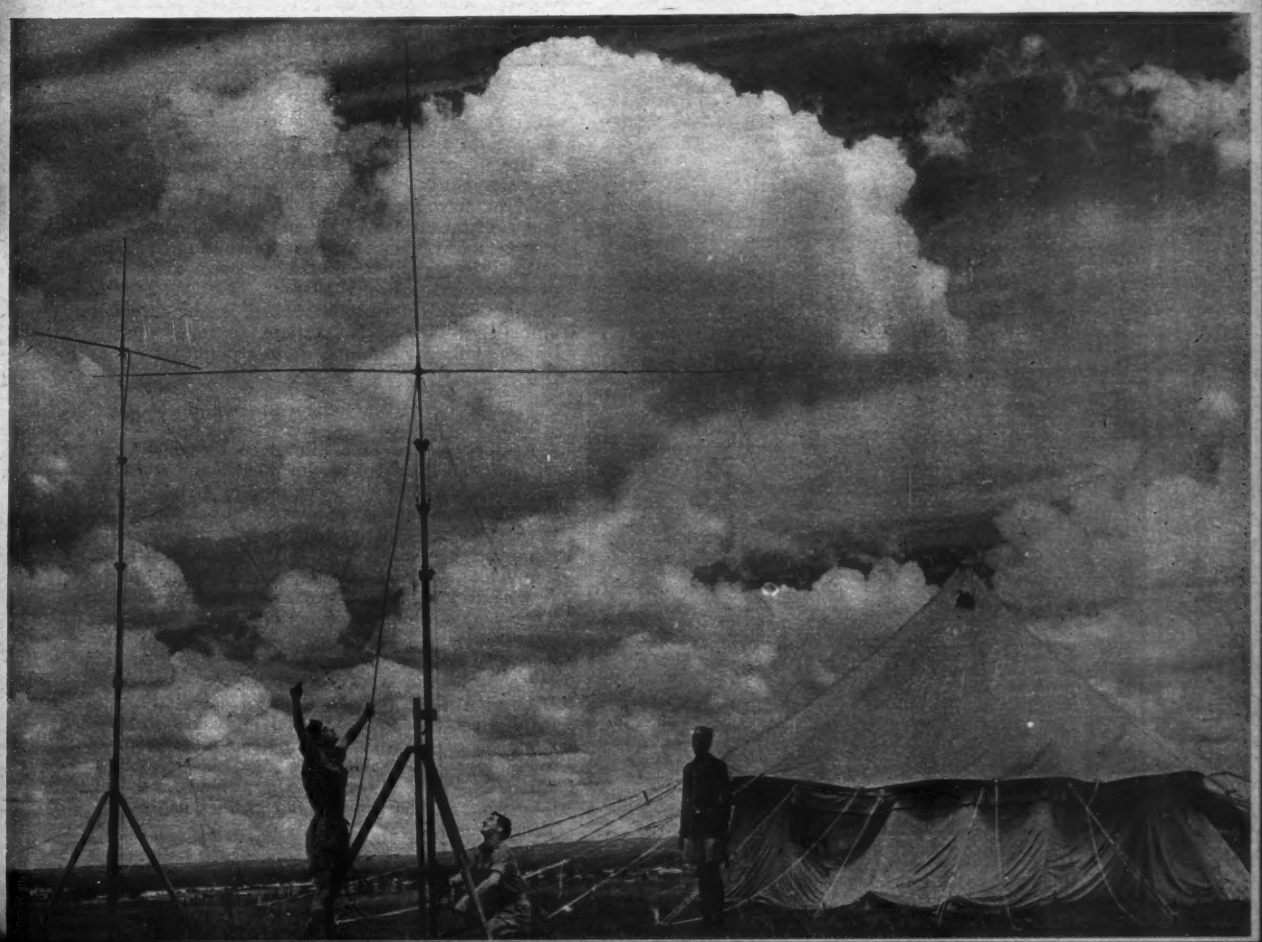
A captain of the Royal Engineers (left) briefs a Lancaster crew. Below, a mobile radar beacon. The crew live under canvas and fend for themselves, with the help of Askaris.

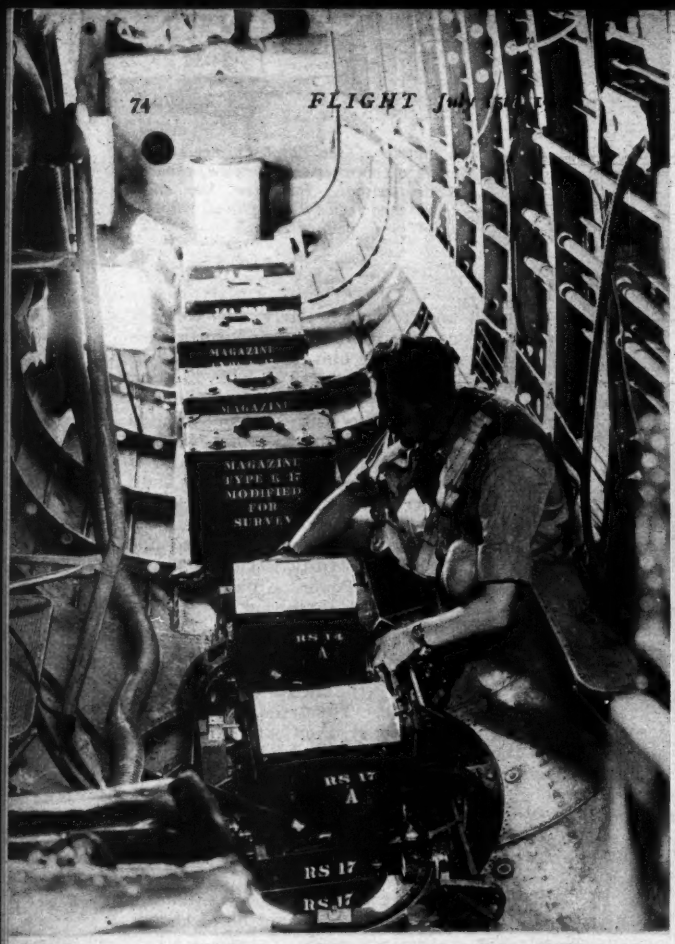
Two cameras are used simultaneously: one photographs the ground beneath, while the other records instrument readings. Each film shows four readings for each ground picture—height, air speed, exact distance from beacon in Gee units, and time. When the map-makers set to work on the photographs they are thus enabled to make allowances for slight flying inaccuracies.

The work would be quite straightforward if the sky were cloudless from five in the morning until four in the afternoon; unfortunately the weather usually terminates most sorties before all the film has been expended. A Lancaster may be able to start photographing at 6.30 a.m. in perfect weather with no clouds; often by 8 a.m. the sky has become clouded with cumulus from 8,000 to 20,000ft (Nairobi itself is 5,000ft above sea level) and by 2 o'clock a first-class thunderstorm has been built up by "cu nimbs" reaching to 35,000ft. In the region of Mount Kenya and Mount Killimanjaro one of the most unpleasant sights for a pilot is the formation of cloud. From quite clear conditions at 8 a.m. to 10/10th cumulus can take as little as 20 minutes in the morning. Thus, the crews of the Lancasters often find that they must return to their airfield on instruments.

A great bugbear is the filling-in of gaps in the areas where a previous run was spoiled by small patches of cloud. At the best of times the clearing-up of other people's work is a bad job; in this instance it can be infuriating.

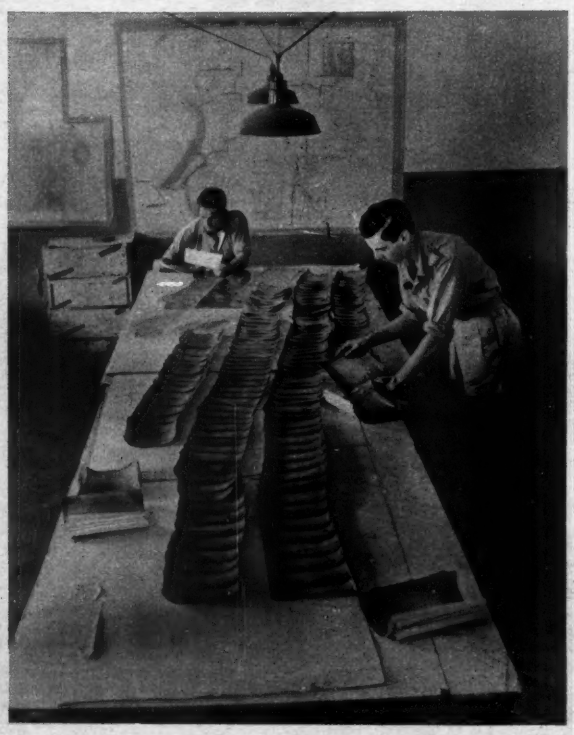
Another drawback to blind flying is that at Eastleigh the "Babs" can occasionally be picked up only at ranges under two miles, rendering it utterly useless, while the V.H.F. transmitter on the ground can only be picked up





The navigator, working his GH set, gives the pilot his course (top right). On the map the hyperbolic lines are for GH navigation.

The camera operator (above) feeds his two cameras with fresh magazines. Below, Engineers are laying out prints for checking before despatch to England.



AFRICAN SURVEY...

when the aircraft is almost overhead. Luckily most crews manage to maintain position by wireless.

The country being mapped by the Lancasters varies from permanently snowcapped mountains to dense jungle, from parched plain to highly cultivated European coffee and tea plantations. Rivers stand out at enormous distances, showing as a green strip winding from one horizon to the other, and native villages appear exactly as a bunch of mushrooms surrounded by a black circle (the latter a thorn hedge for protection at night from dangerous animals). The roads, perhaps 50 miles apart, show as brick-red lines stretching quite straight as far as the eye can see.

A Costly Stampede

A story is told of a pilot who returned from a sortie to Juba, on the edge of the jungle, and found a brace of elephants strolling along the landing strip. They appeared in no hurry, obliging the pilot to "buzz the strip" in order to rout them. On landing he was met by an infuriated Commissioner who pointed out that these particular pachyderms had, at great expense, been partially tamed and were just ready for shackling and exporting at a handsome profit. They had now bolted into the jungle, the profit had disappeared, and what was the pilot going to do about it?

The airfield at Eastleigh is the main landing ground for Nairobi and is 5,000ft above sea level, which means that, apart from the short rainy seasons, the temperatures maintain a fairly steady level between 75 and 80 deg F. Tropical kit is worn all through the year, or blue when working at night. The main road to Rhodesia and South Africa now passes through the airfield, and the traffic is increasing all the time. Civil airlines use one side of the airfield.

POWER-OPERATED CONTROLS

New Electro-Hydraulic System Developed for the Saro SR 45

AMONG the many problems which attend the design and construction of very large aircraft is that of flying-control operation. The speeds of modern large aircraft, and the physical size of the control surfaces of such giants as the Saunders-Roe SR 45, make some form of power operation essential. Further complications arise from the fact that the pilot must have available full control at all times, even if some part of the main system should fail.

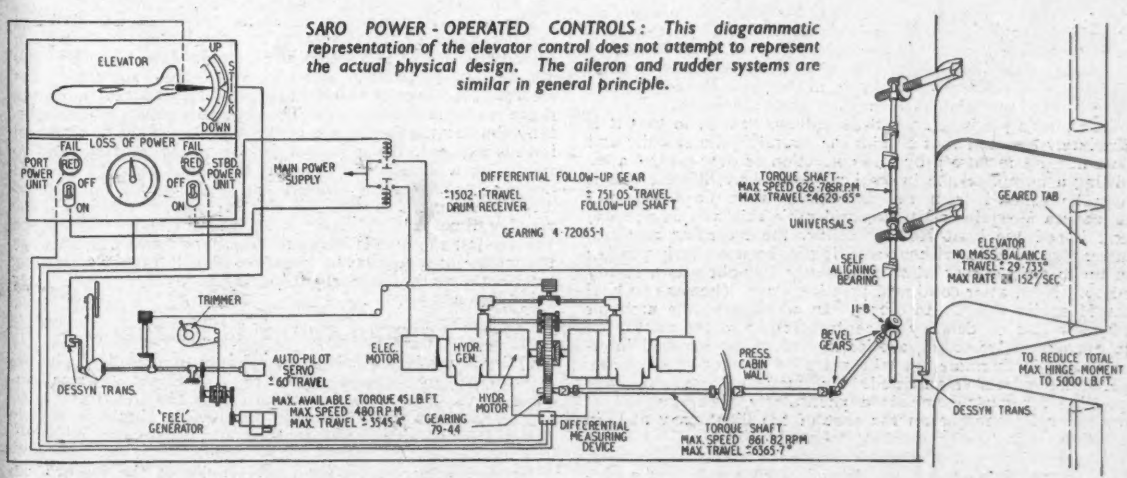
The sysem which has been developed for the SR 45, and which is, of course, applicable to other large aircraft, is the result of co-operation between Saunders-Roe and Boulton Paul, the latter firm having designed and developed the power unit, which comprises two identical electro-hydraulic torque converters. Three independent systems are used, one each for elevator, rudder and ailerons; all major components are interchangeable.

Details of the new power-control system were disclosed by Saunders-Roe yesterday. The principle of operation is as follows: Initial power is supplied by a constant-speed electric motor operating off the aircraft 120v. DC supply, with battery float. The constant-speed variable-torque output of the electric motor is fed into a hydraulic variable-speed unit, comprising a variable-capacity hydraulic pump and a fixed-capacity hydraulic motor. The output of the complete assembly is thus a variable speed, with a limited maximum torque drive. The limit on torque is provided by a suitable relief valve in the hydraulic circuit; the maximum output speed is governed by the respective hydraulic pump and motor capacities. Control of the variable-speed unit is obtained by adjustment of the hydraulic pump's specific capacity.

An infinitely-variable speed drive is thus obtained from the output of the hydraulic motor. This is taken direct to the appropriate control surface via torque shafts and gear trains, terminating as an arc control by means of a mechanical screw jack and radius-arm assembly. In practice, several screw jacks in parallel are employed.

Positional Control

Control of the surface, so far outlined, would be purely velocity control. That is to say, the rate of operation of the surface would be proportional to the pump capacity setting. In order to obtain a positional control (as on an orthodox aircraft) a differential link has been incorporated whereby the output displacement is fed back as a cancelling signal when positional alignment has been reached. A differential gear box



SARO POWER-OPERATED CONTROLS: This diagrammatic representation of the elevator control does not attempt to represent the actual physical design. The aileron and rudder systems are similar in general principle.

Power-operated Controls . . . . .

connects the input and output of the overall power unit, the differential action controlling the hydraulic pump capacity.

In order to provide a safeguard against failure of the electrical or hydraulic equipment, these units are duplicated, and the two irreversible output-drives fed into a common main differential gear, the resultant total output representing the main drive to the control surface. Failure of one power unit reduces the maximum total output speed by 50 per cent, but maintains full output torque.

The first stage of jack operation comprises a worm-and-wheel reduction The driving shaft is connected in series with the worm shaft, through universal joints, but the worm itself is held on the shaft by shear keys, set to shear at 100 per cent maximum overload. Thus, if a jack should seize, through some unpredictable cause, and sufficient torque is applied to the driving shaft, the shear keys will fail, freeing the jack and allowing the torque shaft to continue operating. With this object in mind, the control surfaces on the aircraft have been split up into sections, one section per jack, so enabling the above scheme to operate.

The pilot's controls for the SR 45 are of a conventional type, with bar-operated rudder control and stick-operated elevator and aileron controls.

From the pilot's aspect, the controls feel quite orthodox, stick-loading increasing with stick displacement and aircraft speed. These values are supplied by a synthetic "feel generator," which can be adjusted to suit requirements. This is, basically, either a hydraulic ram or a spring connected directly to each of the pilot's controls. Provision is made for varying the centralizing force, which is proportional to aircraft speed.

A simple method of presenting to the pilot the behaviour of his power control system is employed. An overall picture of control position and accuracy of follow-up is given by two concentric desynn pointers, one indicating pilot's control, and the other indicating the position of the corresponding control surface. Warning lights and indicators are incorporated on the instrument panel, giving evidence of power-unit failure.

Each unit of the power system comprises a 120v. 7½ h.p. electric motor running at 4,000 r.p.m., driving a three-bank hydraulic generator at 2,000 r.p.m. through a gear reduction built integral with the electric motor, with a hydraulic motor directly attached to the generator unit forming a complete self-contained unit with all auxiliary equipment; there are no external pipes or connections.

The hydraulic generator consists of a casing which houses a rotor having three banks of five cylinders, the rotor being carried in ball bearings and driven from the electric motor. Concentric with the rotor, and supported in the casing, is a stationary porting stalk drilled for oilways to feed the banks of cylinders. Surrounding the rotor, and in the plane of the pistons, special ball-bearing slides are fitted which are capable of being moved eccentrically to one side or other of the motor, so that when concentric to the motor no stroke is imparted to the pistons and consequently there is no delivery. Movement of the slide to one side or other from the coaxial position imparts stroke to the pistons, according to the distance the slide is moved, the direction of slide movement determining the direction of flow from the generator.

Two of the three slides are mechanically coupled and move as one unit, so that the output from two banks is supplied for power operation. The third bank is used for supercharging the inlet to the power banks and control of the slides operating the power bank, and operates on the live-line principle, i.e., delivering oil at a predetermined pressure as and when required, the pressure being controlled by a spring and pressure cylinder acting on the slide, causing it to position itself automatically in accordance with the delivery requirements.

The Hydraulic Motor

The slides which operate the power bank are controlled by a servo-valve mechanism, and the power-bank output is fed to the hydraulic motor, which is of the elliptic-cam type and has seven cylinders.

In the Saro system, the driving shaft of this motor is directly coupled to one side of a differential gear box from which is taken, through suitable gearing, a high-speed power take-off shaft operating the control surface through suitable mechanism, and which also provides the feed-back to the pump control for cancelling-out the input from the pilot's control to maintain the control surface in a position relative to that of the pilot's control column.

The hydraulic system functions as a closed-circuit system. The return from the hydraulic motor is fed back into the suction line of the hydraulic generator, internal leakage only requiring to be made up. This is automatically taken care of by the third bank of the generator which, as previously mentioned, supercharges the power bank through a reducing valve at a constant pressure of approximately 50 lb/sq in.

All the oil used is passed through a Vokes filter before reaching the pumping elements, and the effects of pipe dilation associated with long pipe runs are entirely eliminated by reason of the very small quantity of oil in actual circulation. The hydraulic motor maximum speed is 480 r.p.m., and the torque developed by each motor is 50 lb/ft. The usual blow-off valves are fitted across all delivery lines to prevent overloading the electric motor.

In the SR45 the current supplied to the power controls will be taken off the main bus bar of the aircraft, which is supplied from four generators, each driven off a different pair of coupled main engines. Any one of the generators is capable alone of providing sufficient power for the operation of the controls, and, further, there is sufficient capacity in the batteries to provide at least half an hour's running.

GUST HUNTING

(*Continued from page 60*)

route. What complicates the navigator's job, and demands an extremely high degree of professional skill, is the necessity to keep an accurate air plot whilst flying at large variations in height with, perhaps, considerable variation both of wind direction and velocity; in addition to this, it is the navigator's duty to take the temperatures when gusts are found.

The pilot's job is of an equally arduous nature, in that it is absolutely essential that he flies the aircraft quite steadily and does not put in false g by late correction or over-control after hitting a bump. Some indication of just how difficult this is may be gleaned from the fact that, when Capt. Thomas (already a Mosquito pilot of considerable skill and experience) first joined the Gust Research Unit, the recording accelerometer showed that, without realizing it, he was slowly putting in up to 0.2 g during what he honestly thought was a steady climb. Now, after continued practice, Capt. Thomas can hold the Mosquito steadily to 0.05 g. In addition to the need for concentration on delicacy of control, it is also the pilot's job to operate the recording accelerometers at the required intervals and, furthermore, to take notes on his knee pad of any particular effects manifested. As may be realized, this questing for gusts demands a particularly high standard of professional technique on the part of the flight crew and, in addition, is in itself a gruelling labour.

The Peravia recording accelerometer is made by Peravia, Ltd., Berne, Switzerland, and is a clockwork unit with a continuous running time of about 45 minutes. The trace is made at 0.1-second intervals on a waxed-paper film, against a time base of 2 mm/sec, and the instrument provides a record of positive and negative accelerations from +10 down to −4 g, the film being graduated in 0.2 g divisions.

The other recording accelerometer employed was designed and developed by Mr. Barnes, of the R.A.E., and is electrically driven at either of two speeds as required. Low speed provides a time base of ½in/sec, and high speed gives 2in/sec. The recording medium is standard 35mm film and the indicating range is plus and minus 5 g. The operating principle is delightfully simple: the film passes across a projected slit of light and is thus exposed, the g pointer obscuring the light slit and so producing a white trace line on the film, wavering up and down according to the acceleration imposed; this can be read directly against a datum line also exposed on the film. The running time at high speed is 2½ minutes and at low speed 10 minutes; the unit is thus run only during traverses through the middle of a gust layer, when the pilot feels that something sufficiently marked is likely to justify it.

CIRCULATION INCREASE

WE still receive occasional complaints from readers who are unable to obtain a regular copy of *Flight*. A small increase in paper supplies now permits most demands to be satisfied and readers who experience difficulty in obtaining weekly copies through their newsagents should advise the publishers direct.

Regular subscriptions for postal copies of the journal can again be accepted.

DESCENT on DEAUVILLE

Popular Continental Rally: Helicopter Joins In

THERE is no doubt that the Deauville Air Rally has become one of the most popular Continental meetings of the year. On the week-end of July 3rd/4th, no fewer than 72 private aircraft, flown by members and associate members of the Royal Aero Club, flew over to St. Gatien Airport, which serves Deauville, five miles away on the coast. In addition to these a number of light charter types arrived, and the total of guests entertained was over 260.

Two competitions are arranged each year, one for the Deauville Aviation Cup given for the winner of the Arrival Competition, and the other for what may be described as first impressions on landing at Deauville. Mr. A. J. Linnell, flying a Gemini from Northampton, won the Arrival Cup; Mr. A. J. Bradshaw (Proctor), and Capt. C. W. Byas, R.N. (Auster) were second and third respectively. The difference in times indicated from the pre-determined E.T.A. given to each competitor was 4.8 sec, 5.8 sec, and 12.8 sec. Mrs. Marie Duncan Davis and Capt. C. W. Byas, R.N., were the winners of a handsome bottle of perfume and a striking trophy for their remarks on landing. Mrs. Davis, who is from the Shoreham club, said, "I have two loves—my country and Deauville." Capt. Byas remarked, "The sun's rays seem to lead towards Deauville."

A magnificent ball was arranged at the Casino for the Saturday evening, and it was on this occasion that the prizes were presented by Capt. Jacques Allez, M.B.E., Treasurer, F.A.I., and Vice-president of the Aero Club of France. A speech of welcome was also made by the Lady Mayoress, Madame Fossorier. On behalf of the Royal Aero Club guests, Mr. S. Kenneth Davies, Vice-chairman of the R.Ae.C., thanked M. Francois André, the principal host and President of the Société des Hotels et Casino, and his confrères, among whom were included Commandant M. Hurel, President of Deauville Aviation (Aero Club Deauville and Trouville), M. Mouchet, M. Olivier and Miss N. Ralph.

On Sunday a luncheon was arranged at the luxurious Hotel du Golf,

(*Continued at foot of page* 66)

MORE than 80 light British aircraft (if Rapides, Doves, and Consuls are included) were parked at St. Gatien airfield for the Deauville week-end. The Wolverhampton and Derby clubs were particularly well represented. Guests were received most cordially, and after passing through Customs in the flower-decorated control building, the party, 250 strong, travelled by bus to the Grand Hotel. The Gemini was flown by Mr. W. Silcock from the West London Club.

The Gyrodyne

Dr. Bennett Outlines its History and Describes its Special Features

S/L. Arkell demonstrates the Fairey Gyrodyne's hovering capabilities at Heston airfield.

MEMBERS and friends of the Helicopter Association of Great Britain were the guests of the Fairey Aviation Co., Ltd., at Heston last Saturday, when Dr. J. A. J. Bennett, head of the helicopter branch of the company, gave a lecture on the Fairey Gyrodyne. Afterwards a colour film was shown, which included a few shots from the recent world's record flight, when S/L. Basil Arkell averaged 124.3 m.p.h.

After an interval for tea, S/L. Arkell gave some very convincing demonstration flights on the Gyrodyne. As the machine is still classed as experimental, passengers could not be taken, but an exception was made in the case of Mr. H. A. Marsh, chairman of the Association and manager and test pilot of the Cierva Autogiro Company, Ltd., who flew as a passenger "at his own risk." After the flight Mr. Marsh spoke highly of the smoothness of the Gyrodyne.

Particularly impressive were Mr. Arkell's high-speed flights. One has become so accustomed to seeing helicopters hovering, putting down and taking off vertically, that it was very refreshing to see one moving really fast horizontally, a useful reminder that hovering is not the only asset of the helicopter. The occasion was also a memorable one in the history of the Helicopter Association in that it was the first time a flying demonstration was given after a lecture. It was evident that members and their friends thoroughly appreciated the fact, and the attendance was good in spite of the rival attractions at Gatwick.

A Private Venture

Dr. Bennett began by paying a tribute to the board of the Fairey Aviation Company for their firm belief in the gyrodyne principle from the beginning, and for having sufficient faith in their own judgment to sponsor it entirely as a private venture.

The conception of the gyrodyne, Dr. Bennett said, originated in this country shortly before the war, to fulfil a Naval requirement for a rotary-wing aircraft capable of operating from the deck of a ship. It is true that the possibilities of the gyrodyne gained immediate recognition by the award of a contract from the Air Ministry, but the war intervened, and it was not until 1946 that the development of the gyrodyne really commenced. During the intervening period the helicopter became a fully fledged flying machine incorporating certain features of the gyrodyne, viz., the aerodynamic asymmetry of a single lifting rotor in torque balance with a single non-lifting airscrew; the variation of power distribution between branch transmission systems; and lastly the direct control from foot pedals of the collective pitch of the non-lifting airscrew for effecting control of the aircraft in yaw. All of these gyrodyne features have become standard practice in helicopter design.

Where the gyrodyne differs in principle from the standard form of helicopter is in the azimuth location of the non-lifting airscrew. At first sight this might appear to be a matter of minor importance, any position in azimuth from zero to 360 deg. being as good as any other, and the choice being determined merely by a desire to mount the non-lifting airscrew as far as possible from the axis of the lifting rotor, thereby keeping the power absorbed by the non-lifting airscrew at a minimum, and the power applied to the lifting rotor at a maximum. The gyrodyne, on the contrary, aims at keeping the rotor power as low as possible and utilizes the remainder in the non-lifting airscrew for the useful purpose of forward propulsion. Although part of this remainder is used normally for torque balance in hovering flight, the whole of the remainder is available always as a reserve for vertical climb under abnormal circumstances. A slow rotation of the fuselage in vertical climb can effect a considerable change in power distribution between the airscrew and the rotor. Consequently, vertical climb can be temporarily boosted whenever necessary.

What is a "Gyrodyne"?

According to the British Standard Glossary of Aeronautical Terms, aircraft are classified into two separate categories, "aerodynes" and "aerostats," an aerodyne being a heavier-than-air aircraft. A gyrodyne, therefore, is a kind of gyratory aerodyne. In other words, a gyrodyne is a form of helicopter in which the rotating wings are basically the sole means of sustentation but not of propulsion, the main objective being to keep the power transmitted to the rotor as low as possible, and hereby to provide greater safety in operation. It so happens that the steps taken in the design of this form of helicopter to enhance its safety result also in a higher top speed, though speed is considered of secondary importance to safety. The higher the forward speed, the less proportion of the total power is delivered to the rotor. Hence the main transmission is not so highly stressed at top speed as at slower speeds, thus ensuring a higher factor of safety.

A further safety feature of the present gyrodyne is its low-pitch operation under all conditions of flight and, with its relatively low disc loading, it possesses well-proven qualities of the gyroplane which the helicopter should seek to retain. It is regrettable that present-day helicopters should have sacrificed safety to such a degree that the Parliamentary Secretary of the Ministry of Civil Aviation was obliged recently to refer to the matter in the House of Commons. While we do not entirely agree with the statement made on that occasion, the high-pitch operation of helicopters is a definite source of danger, but it should not be assumed that all helicopters are necessarily dangerous. The gyrodyne, by keeping rotor power, disc loading and pitch as low as possible, increases the margin of safety.

The Gyrodyne Principle

Attempts have been made in the past to discover a method of propulsion for helicopters such that the tip-path plane should remain horizontal in level flight. Probably the nearest approach to the gyrodyne was an arrangement described by Oehmichen, in which translational flight was effected by differential variation of the thrust of a group of airscrews. The use of a single airscrew was discarded, however, because the machine would be unable to hover owing to the unbalanced thrust of the airscrew. The gyrodyne does not attempt to keep the tip-path plane horizontal under all conditions of flight, nor to maintain constant power distribution between rotor and airscrew. The single outboard airscrew maintains torque balance, not only with varying rotor torque, but at zero forward speed, in which case the tip-path plane is inclined backwards, so that the forward thrust of the airscrew is balanced by the backward component of the rotor thrust.

Translational speed is achieved by decreasing this backward inclination of the tip-path plane, and not until a fairly high forward speed has been attained does the tip-path plane assume a horizontal attitude. Beyond this forward speed, of course, the tip-path plane has a slight forward inclination. In other

The Gyrodyne . . . . .

words, the normal operating condition of the gyrodyne is with both the fuselage and the tip-path plane substantially level.

Periodic Blade-tip Stall

At one time it was thought that the better propulsive efficiency of a driven sustaining rotor compared with that of an airscrew would result in a higher top speed for the helicopter than for the gyroplane. In this respect the helicopter has not come up to expectations. A bugbear of the helicopter, affecting its propulsive efficiency in forward flight, has been the periodic blade-tip stall. This shortcoming is minimized in the gyrodyne.

Perhaps this point is best explained by considering the axial component of flow through the rotor disc, i.e., the flow of air in a direction perpendicular to the tip-path plane. The autorotative rotor of the gyroplane is inclined at a positive angle of incidence with respect to the flight path, and the rotor is kept rotating by the axial component of flow which, in this case, is directed upward relatively to the tip-path plane. A change in axial flow does not alter the blade angle of attack equally from root to tip, but affects the root portion of the blade most. Hence, an increase in axial flow merely extends the periodic stall at the blade root, and the operation of the rotor remains fairly smooth, though of course, if too great a proportion of the blade becomes stalled, the vibration from the rotor may be excessive.

Basic Limitation of the Forwardly Inclined Rotor

The periodic blade-root stall of the autorotative rotor, however, is relatively innocuous in comparison with the blade-tip stall occurring when the rotor thrust of the helicopter is inclined forwardly for propulsion. The rotor disc then makes a negative angle of incidence with respect to the flight path, as a result of which the axial flow through the rotor increases with forward speed. To compensate for the reduced angle of attack caused by the increased axial flow, the blade angle has to be increased, and at a high forward speed it is generally greater than the maximum value at which the rotor would autorotate in power-off flight. Hence, in the event of power failure, the blade angle must be quickly decreased to prevent the blades from losing their kinetic energy and stalling, though, on the other hand, a sudden large reduction in pitch may be extremely dangerous.

The effect of the increased axial flow on smoothness of operation of the rotor is more marked than in the gyroplane because, in the helicopter with the rotor forwardly inclined, the axial flow is downward, and an increase in axial flow affects the tip portion of the blade least. Consequently, when the mean collective pitch is increased to compensate for the increased axial flow, the blade angle at the tip is excessive, and the blade tip approaches the stall cyclically at high translational speeds, especially as the angle of attack on the retreating blade is already high due to blade flapping or cyclic feathering resulting from the aerodynamic dissymmetry of forward flight. The helicopter rotor, therefore, becomes rough in operation at high pitch in forward flight, though it may be quite smooth at the same forward speed in auto-rotative flight.

Advantages of Low Pitch

It may be argued that there is no need for the helicopter to travel fast; there are plenty of uses awaiting slow-speed machines for some time to come. But even if one neglects the possibilities of increased speed offered by the gyrodyne principle, the smoothness of low-pitch operation is in itself a desirable attribute. It is unnecessary to exceed the maximum autorotative blade angle to compensate for an increased axial flow resulting from a forward inclination of the rotor. In other words, the propulsive powered-rotor departs too far from the satisfactory condition of operation of the autorotative rotor, and the relatively non-propulsive power-rotor of the gyrodyne avoids the limitations of the two extremes.

(*To be concluded next week*)

MODEL AIRCRAFT RALLY AT RADLETT

THE third annual All-Herts Model Aircraft Rally will take place at Radlett airfield, by kind permission of Sir Frederick Handley Page, on August 22nd. Mr. F. Guest, who last year took first prize for a speed of 98 m.p.h. with a "Dynajet" model, hopes this year to fly a twin "Dynajet" model aircraft which may exceed 150 m.p.h. If conditions permit and the model has completed its tests an attempt may be made on the world's speed record, now held by the U.S.A. with a speed of 162.3 m.p.h. The programme for August 22nd begins at 10.30 with rubber and glider duration competitions, followed by power duration, concours d'elegance, and control-line flying events. Admission to the airfield is free and visitors may obtain copies of the programme in advance by writing to the Hon. Secretary, Mr. P. Brown, 6, Abbeymill Lane, St. Albans, Herts, and enclosing 7½d which includes postage.

PRESENTATION DAY AT CRANFIELD

ON July 7th, the first presentation day at the College of Aeronautics, Cranfield, 36 diplomas were awarded—10 with distinction—to students going down at the end of the first two-year course. Of this number 17 had specialized in aircraft design, 12 in aerodynamics and seven in propulsion. All the students, apart from those who are permanent commissioned officers in the Royal Navy and Royal Air Force and who will return to their Service duties, have obtained good positions in industry, research establishments or in the airline corporations.

Mr. E. F. Relf, principal of the College, said that this presentation day represented the end of the first stage of this new experiment in education, the results of which would be shown by the students when they went out into the world. It also marked the beginning of the traditions of the College.

It was generally agreed, he said, that the best way in which the staff of such an establishment could preserve a fresh outlook was by taking part themselves in original research and although, because of the difficulties with which all concerned with the inception of the College had had to contend, it had not yet been possible to do much yet in this direction, eighteen original research reports had been produced at the College during the first course, to which three students had contributed as co-authors.

Diplomas were presented to students by Mr. George Tomlinson, Minister of Education, who was entertaining and effective in a speech in which he mentioned the importance of beginnings in the founding of a tradition and paid a tribute to the work of the Principal who, he said, could make or mar the College at the outset. While congratulating the successful students on the results of their work, he stressed the need for good fellowship and for being proficient in the business of living as well as in earning a living.

In addition to the diplomas, there were two special awards—the Governors' prize of £20, to be spent on books, for the best all-round student of the course, and the Principal's prize of £10, to be spent on books and instruments, for the best piece of original work done during the course. The first was won by A. Lightbody and the second by J. H. Hunter-Tod, partly for his thesis on Sandwich Construction and partly for his work as co-author in the preparation of two of the research reports produced during the course.

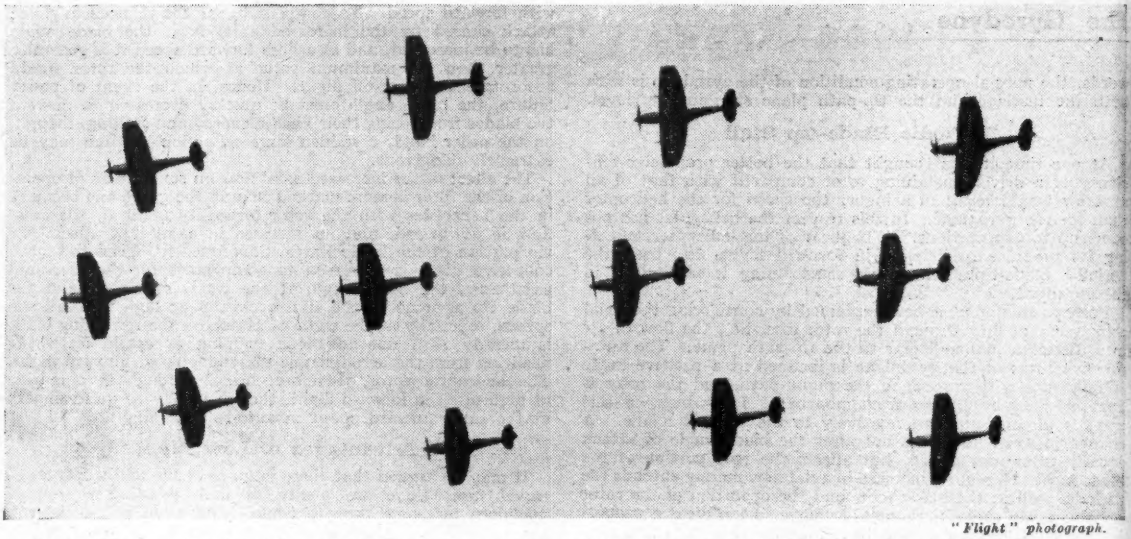
Air Chief Marshal Sir Edgar Ludlow-Hewitt, chairman of the Board of Governors, Lord Brabazon of Tara and Sir A. H. Roy Fedden also spoke. The fifth Sea Lord, Vice-Admiral Sir Philip Vian, Rear Admiral (E.) Sir John Bedale, Air Marshal Sir Ralph Sorley, Air Marshal Sir R. Victor Goddard and Sir Melvill Jones were among those on the platform.

D. R. POBJOY

AMONG the passengers who lost their lives in the accident near Northolt on July 4th was Mr. D. R. Pobjoy, whose name will be remembered by many from the early days of the light plane movement, although during the last two or three years his activities were outside aviation.

Douglas Rudolf Pobjoy was a Bristolian and a Captain in the R.A. (Territorial Army Reserve). He came into the aviation fraternity in the middle 'twenties, when he designed the little light plane engine that came to be used in several aircraft types in later years. His first engine was intended for the Lympne trials in 1926, but as it did not pass its type tests in time, one of the two Cranwell light planes designed by F/L. Comper was unable to take part in the competition. Pobjoy's collaboration with Comper continued after Pobjoy Airmotors was formed, the Pobjoy engine being fitted in the Comper Swift.

In the course of time, others obtained a controlling interest in Pobjoy's firm, and he next appeared at Rotols, where he designed the sleeve-valve engine for driving auxiliaries in large aircraft. When the policy of that firm reverted to purely airscrew work, Pobjoy's fertile brain sought other avenues. He recently designed a tractor of which he expected great things, and he had actually been on a visit to Finland to obtain financial backing for it when he met his death. In this he was successful, and it seems a cruel stroke of fate that his life should be taken just at the moment when there was every prospect of making a good start in this new sphere.



"Flight" photograph.

SQUADRON AIR DRILL: The Spitfires of No. 601 (County of London) and No. 604 (County of Middlesex) Squadrons, R.Aux.A.F. passing over Gatwick in "Flights line astern."

Ambitious Air Pageant

Great Variety and Excellent Timing of Events

NOT since the days of the Hendon R.A.F. displays has the public been treated to a flying spectacle of such scope and variety as that staged by the *Daily Express* at Gatwick last week-end. Unseasonable weather—dull, cold and with cloud ceiling little more than 1,500ft—failed to discourage either the performers or some sixty to seventy thousand people who travelled to Gatwick for the occasion.

For those fortunate enough to see many of the important flying meetings each year, in particular the S.B.A.C. Display, there were several new items on the long programme to add novelty, while the great diversity of events catered for every individual taste. Praise is due in particular to the pilots from each of the three Services for their really immaculate exhibitions, and to the organizers for a well arranged and expertly timed programme. Although each event was worthy of separate description, space permits little more than a mention of outstanding turns.

To open the main afternoon flying programme (during the morning spectators had seen A.A. gun drill, a W.R.A.F. Band, police dogs and light aircraft demonstrations by Duck, Proctor V, Fairey Junior, etc.) perfect formations of six Meteor 4s and six Vampires flew past, and these were followed by representative civil airliners: a B.E.A. Viking, K.L.M. DC-6; B.S.A.A. Tudor IV; Air France Languedoc; Skyways York; B.O.A.C. Solent; Olley Air Service Dove.

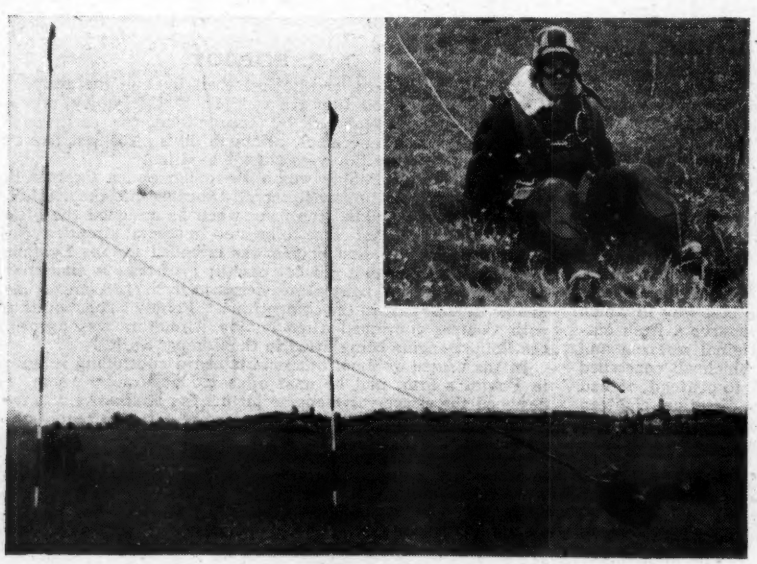
Event 4 was grimly impressive. Lincolns are not intended to fly in formation, but never have six of these speedy "heavies" (in two close vics) swept over with a more purposeful appearance.

Four Vampires were the first of the fighters after the fly-past to demonstrate the very high standard of formation flying now achieved in the Services. Their aerobatics were unfortunately hindered by the low cloud. Later in the afternoon three Meteors also added another magnificent high-speed formation event, while a fourth, flown by F/L. Chambers, indulged in impressive individual aerobatics at very low level. S/L. Wootton, Capt. Tucker and F/L. Windle are noted for the formation rolls, and it was a great disappointment not to see an example from the Horsham St. Faith trio on this occasion.

Everyone was glad to see Spitfires represented, and no fewer than twelve Mk. 16s, in the hands of expert Auxiliary pilots, went through squadron drill, including in their repertoire not only an arrowhead formation but a new arrow with "feathered" tail composed of a final vic.

C.F.S. lived up to their traditional high reputation with a skilful instructor-and-pupil act in two Tigers, which many people voted the most entertaining show of the day.

Whirling-wing types were well represented, and a Hoverfly 2, Westland Sikorsky S.51 and Irvin Bell were each put through their omnidirectional paces. The S.51 flew off in the direction of Fleet

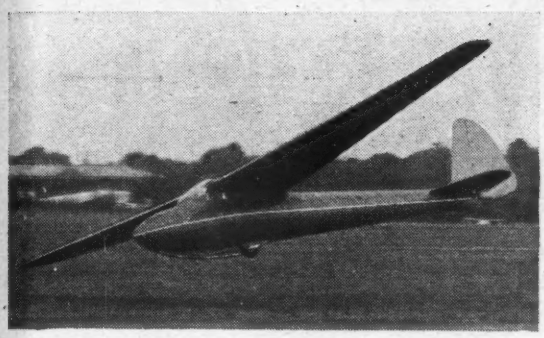


"Flight" photographs.

WAIT FOR IT: Two photographs showing Michael Cain waiting to perform and performing his towline pick-up stunt.

"Flight" photographs.

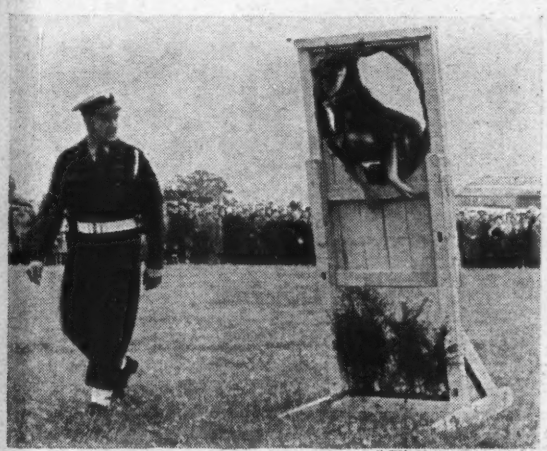
(Top, left) The Fulton Airphibian in a disembodied state. (Right) Instructors from the R.A.F. Parachute Training School jumped from a moored balloon. (Left) The Eon Olympia touching down across wind at the end of its show. (Below) The R.A.F. Sikorsky Hoverfly 2 rises to the occasion.



Street and returned at about five o'clock dangling bundles of evening papers containing an account of the air pageant and a photograph of itself during an earlier demonstration. The best example of parking down that we have seen to date, was given by the S.51 which flew along the perimeter track at about 20 feet, stopped, turned right and eased down between other aircraft in the line-up.

Navy Show

The Navy, flying in Sea Furies and Sea Hornets, was superb. Six Sea Furies formated, then demonstrated landing-on and flying-off in quick succession. A single Sea Fury, flown by Lt. Elliott, was put through some faultless aerobatics and incredibly tight high-speed turns around the airfield. A pair of Sea Hornets (Petrie and Lee Hay at the controls) rolled from only a few hundred feet, keeping station as if bolted together. To everyone's amazement they then repeated the performance, each with an engine feathered—a truly remarkable effort, bearing in mind the poor visibility and ceiling.



"Flight" photograph.

ALLEZ OOP: An incident during the demonstration by Alsatians from the R.A.F. Police Dog Training Establishment.

First event on the "sensation" list was the towline pick-up by an American team using a Stinson Reliant. Mr. Michael Cain (who in this country might well be known as "the jerk") was whisked off the ground on a harness and nylon rope, having been hooked, message fashion, and after a circuit or two in tow, was slowly wound up to a trap door beneath the cabin. Bernard Lynch was the next to receive a "kick in the pants" when he very pluckily ejected himself from a Meteor flying at high speed in cloud. One had a fleeting glance of the machine as Capt. Scott flew it by overhead, then there was a distinct bang and Lynch, in his Martin-Baker ejector seat, appeared through the cloud. On seeing the ground he baled out of the seat and floated down on his separate 'chute. Mr. Gwynne Johns later also made a slightly delayed demonstration drop from a Dakota flying at only about 2,000ft.

Seen for the first time in this country, the Fulton Airphibian performed very well and impressed all by its apparent simplicity. It flew very satisfactorily in the hands of Mr. Robert Fulton, landed, and after a few minutes (during which tail, wings and airscrew were shed), drove around the field on its four little wheels, using the same Franklin power unit.

As the afternoon passed, the Nene Lancastrian and Olympia Eon sailplane were shown, and because the tiny Chilton monoplane was bound by red tape to turns and level flight, an M.18 was used by S/L. Porteous for his aerobatics.

To complete a first-class air pageant, Transport Command and the R.A.F. Parachute Training School combined to show the ever-spectacular airborne assault tactics they employ, dropping men, guns and supplies, followed by Horsa and Hadrian gliders—one of which was later snatched up again.

"Flight" photograph.

TRAINER STYLES: A massive Bristol Buckmaster advanced trainer, with two 18-cylinder Centaurus radials, seen at Hullavington with one of the recently delivered Percival Prentices (D.H. Gipsy Queen).

Now C.A.S., R.I.A.F.

AIR MARSHAL SIR THOMAS ELMHIRST, who has been Air Officer Commanding, Royal Indian Air Force, since August, 1947, has assumed the title of Chief of Air Staff and Commander-in-Chief, Royal Indian Air Force, in accordance with a decree of the Government of India that this shall be the title of the senior officer of the R.I.A.F. Air Marshal Elmhirst went to India in February of last year as Chief of Inter-Service Administration at Armed Forces Headquarters, under Field-Marshal Sir Claude Auchinleck, and became A.O.C., Royal Indian Air Force, six months later. He was formerly Assistant Chief of Air Staff (Intelligence) at the Air Ministry.

Appointments to King's Household

THE KING has approved the following appointments to fill the increased establishments of Honorary Physicians, Honorary Surgeons and Honorary Dental Surgeons to His Majesty:—

Acting G/C. Campion Aubrey Rumball, O.B.E., M.R.C.P., M.R.C.S., L.D.S. to be Honorary Physician; A. Cdre. Edward Demetrius Dalziel Dickson, C.B.E., M.B., Ch.B., F.R.C.S. (E), D.L.O., to be Honorary Surgeon; G/C. Michael Joseph Pigott, B.D.S., and G/C. Reginald George Joseph Charlesworth, L.D.S., to be Honorary Dental Surgeons.

Principal Air A.D.C. to the King

THE Air Ministry announces the appointment of Air Chief Marshal Sir John C. Slesser, G.C.B., D.S.O., M.C., Commandant of the Imperial Defence College, to be Principal Air Aide-de-Camp to the King, with effect from July 1st, in succession to Air Chief Marshal Sir Roderick M. Hill, K.C.B., M.C., A.F.C., on his retirement from the Royal Air Force.

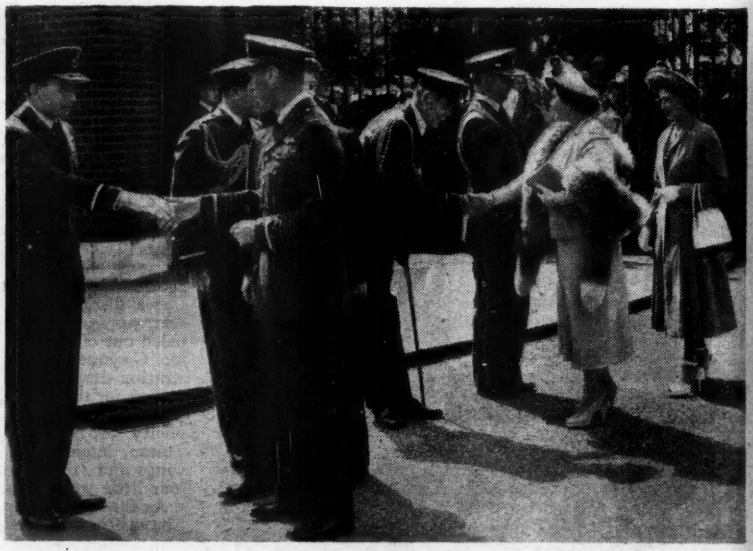
Royal Air Force and Naval Aviation News and Announcements

First W.A.A.F. Post-war O.C.T.U.

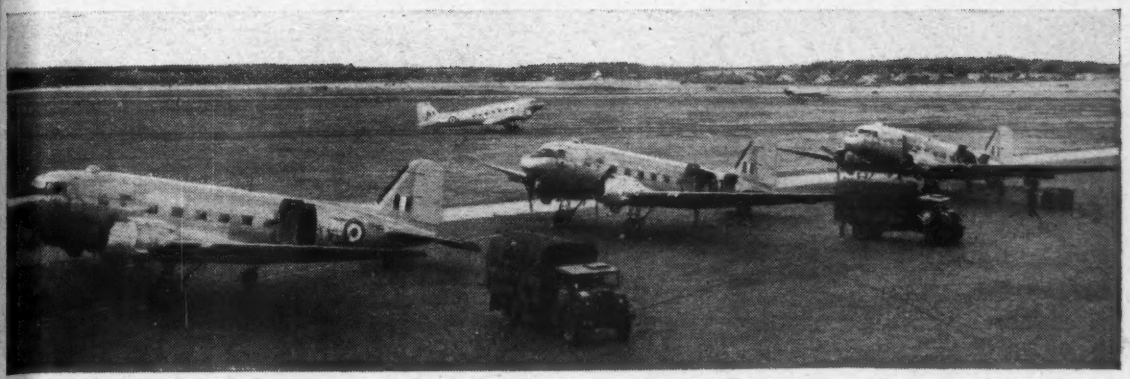
FIRST W.A.A.F. officer cadets have just assembled at the new W.A.A.F. depot, Hawkinge, Kent, for their three months' course.

There are 24 N.C.O.s, including two Warrant Officers and seven Flight Sergeants.

The course includes all aspects of R.A.F. organization and administration, law, drill and physical training, welfare and hygiene, fire prevention, leadership and morale. Stress is laid on educational training designed to broaden the outlook of the future officer to give her the mental and moral attributes essential for a leader, a personnel manager.



ROYAL VISITORS: The scene at the arrival of the King and Queen and Princess Margaret at Cranwell last week. The King is shaking hands with Air Marshal the Hon. Sir Ralph Cochrane, Air Chief Marshal Sir John Slesser and the Rt. Hon. Arthur Henderson are partly hidden behind His Majesty. Marshal of the Royal Air Force Lord Trenchard is shaking hands with the Queen, and Marshal of the Royal Air Force Lord Tedder is about to greet Princess Margaret.



BEATING THE BARRICADES: Transport Command of the R.A.F. are running an extensive freight service into Berlin to defeat the Russian embargo on road and rail transport. The operation is aptly named "Carter Paterson."

Service Aviation . . . . .

Reunion

THOSE members of No. 202 Flying Boat Squadron who wish to attend the reunion provisionally arranged for October 16th, 1948, should contact F/L. (Schnorkel) Snasdell, R.A.F.O., c/o 59, Mandeville Road, Enfield, Middlesex.

R.A.A.F. Anti-invasion Exercise

THE first anti-invasion air exercises ever to be carried out by the R.A.A.F. are now in progress in the Darwin area, the object of the exercises being to establish, at short notice, a forward operations base. When the invasion alarm sounded, aircraft of Transport Command moved the entire field maintenance units and administrative staff of a Lincoln bomber group from their station near Brisbane to Darwin.

During the exercises search will be made off the Darwin coast for "enemy" convoys and high-altitude bombing attacks will be made on targets in the Northern Territory.

Norwegian Honours for Ex-R.C.A.F. Personnel

R.C.A.F. Headquarters, Ottawa, last month announced that His Majesty the King of Norway had conferred the award of King Haakon VII's Cross of Liberation on six former members of the R.C.A.F., and the Medal of Liberation on two former members, in recognition of distinguished services rendered in the cause of the Allies. Those receiving the awards are: Air Chief Marshal L. S. Breadner, C.B., D.S.O. (former C.A.S.); Air Marshal G. O. Johnson, C.B., M.C.; Air Marshal Robert Leckie, C.B., D.S.O., D.S.C., D.F.C. (former C.A.S.); A.V-M. G. E. Brookes, C.B., O.B.E.; A.V-M. F. S. McGill, C.B.; and A.V-M. K. G. Nairn, C.B. The two officers receiving King Haakon VII's Medal of Liberation, awarded in recognition of services rendered as liaison officers with the Royal Norwegian Air Force in Toronto, are F/L. S. G. K. MacDonald and F/L. A. L. Wainwright.

IN THE SUNNY? SOUTH: No. 603 (Edinburgh) Squadron has spent its summer camp at Tangmere this year. The group above shows, left to right, S/L. Gilroy, D.F.C., F/O. Monro, F/O. Scott, F/L Skene, F/L. Anderson, F/O. Meadows, D.F.C., F/O. Moncar, F/O. Kennidy, F/L. Forbes, D.F.C.

Special R.A.F. Short Service Scheme

A FURTHER year or two years' service with gratuity and other benefits is offered to serving members of the R.A.F. and W.A.A.F. due for release by the end of the year and to those who postponed their release. The gratuity is at the rate of £80 a year for R.A.F. officers, £40 for W.A.A.F. officers, £20 for airmen and £16 for airwomen. Other benefits include 28 days' leave, a civilian outfit (unless already issued) or cash equivalent and clothing coupons. No age limits apply to the scheme, which is introduced because of the serious shortage which will result from releases by the end of the year. Airmen and airwomen will retain their rank under current conditions, and officers will be appointed in their existing substantive rank.

Officer Cadetships and Ex-A.T.C.

FORMER A.T.C. cadets who hold the proficiency certificate are now excused the Civil Service Commissioners' written examination when entering for cadetships leading to permanent commissions in the R.A.F. in the General Duties, Equipment or Secretarial Branch or the R.A.F. Regiment, provided they fulfil the other necessary conditions, such as age and educational standard. This concession already applies to serving A.T.C. cadets who hold the proficiency certificate. Ex-cadets who wish to take advantage of this scheme should apply to the Commanding Officer of their old unit, or, if this is closed, to their Reserve Group.

Obituary

THE following casualties are announced with regret by the Air Ministry in the accident to the York aircraft of R.A.F. Transport Command which collided with a D.C.6 of Scandinavian Air Lines on Sunday, July 4th:—

Sir Edward Gent, C.M.G., O.B.E., D.S.O., M.C., High Commissioner for the Federation of Malaya, who was a passenger in the aircraft, and F/L. J. K. Nowrie, G. R. Coates, C. Ingleby, W. T. Trotman, Sig. 1 H. G. Lewis, and Eng. II J. I. Rees.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

SAFETY v. CONVENIENCE

Northolt Machines Should Have Been Diverted

TO be brief, and with sympathy for those that went down at Northolt, I would venture to ask why are multi-engined liners allowed to wallow in the murk around any airfield for 1½ hours? Surely past Bomber Command experience of diversion to airfields within remaining fuel range in the event of 10/10 over base on return showed profit. As you know only too well, hundreds of multis were often involved, and I realize earthbound liners cost money, inconvenience, etc. But surely the reward is worth the diversion. F. C. FORSTER.

Aston, Birmingham, 6.

EMERGENCY CONTROLS

Does Anyone Remember those Fitted in Early Bostons?

A TOPIC that was brought up in conversation recently has not, I think, ever been discussed in the pages of *Flight*. That is, instances of successful use, in emergency, of the rudimentary control system, as fitted to early Boston aircraft.

I saw an example myself at Squires Gate airfield. The dorsal gunner's position (facing rearwards, or was it a swivel seat?) was the site of the controls in question. None of us could possibly see how the gunner could use them. No forward view, no engine controls.

What was their actual duty, does anyone know? Also, have any aircraft been so fitted before or since? Or did I dream I saw this oddity in 1941? J. WESTHEAD.

Fleetwood, Lancs.

MULTI-WHEEL UNDERCARRIAGES

"Comparator" on the Convair XC-99

PERMIT me to accept the challenge of "Imperator," whose amusing letter in your issue of May 20th, caused several ripples up and down my flimsy nom de plumage. I am only too happy to give him the real lowdown direct from San Diego—in place of his long-distance guesswork inspired by second-hand information.

My criticism of the single-wheel undercarriage system of the Convair XC-99 is clearly borne out by subsequent events, as "Imperator" himself tacitly admits in his reference to its substitution by a multi-wheel bogie on the production version of the B-36 bomber. Where "Imperator" neatly boxes himself out of the literary ring is in the equally tacit assumption that the XC-99 will automatically follow suit. However, I have before me as I write, a recent official announcement from Consolidated-Vultee stating that "present plans do not call for the XC-99 to be equipped with multi-wheel landing gear."

Strange that both "Imperator" and H. G. Conway (May 27th issue) are guilty of the same false premise—could they be fooling one another, I wonder? They apparently take it for granted that the XC-99 is destined for the production line, whereas present evidence indicates that it will end up at Wright Field as an experimental "one-off" guinea-pig, just like the Douglas B-19 behemoth before it. In the course of experimentation it will probably have several different varieties of bogie and caterpillar landing gear—which strikes me as good planning for the future. All this must be left to history, of course, but if I see a production version of the XC-99 with a multi-wheel undercarriage within, say, the next 12 months, I will cheerfully swallow those two spurious half-crowns—one for each of my fighting friends.

The final form of the Brabazon undercarriage is anybody's guess, although I'll stake my silver dollar on the combined know-how of the Bristol-Dowty team in this case. Anyway, I feel tolerably assured that the Brab undercarriage cannot possibly match the catastrophic possibilities of the single-wheel system on large aircraft, or the downright clumsy solution seen in Lockheed's new drag reaction shock-strut. Another odd thing is that several British undercarriage designers have now outmatched their American contemporaries in the technique of nose-wheel design, a fact which I trust will not too badly ruffle the feathers of "Imperator's" own commanding nom de plumage. "COMPARATOR."

Los Angeles, U.S.A.

PASSENGER PARACHUTES

Might Have Saved Lives in Northolt Disaster

SOME time ago, on the occasion of the Sabena crash at London Airport, I pointed out that lives were being lost in passenger aircraft which could be saved if parachutes were provided. You added a footnote saying that the Sabena crash was not a case in point, since the machine crashed through a misjudged landing, but overlooked the fact that, since it was an emergency landing in zero visibility, the passengers would no doubt have been told to bale out if parachutes had been carried.

The disaster over Northolt on July 4th might have caused less loss of life if parachutes had been carried. True, there was not much time to jump, and no doubt most of the occupants might have found it virtually impossible to reach an exit with the aircraft twisting and turning so violently. But there *is* such a thing as seat ejection, while the provision of cabins which could be ejected *in toto* and supported by a master parachute is not so absurd as it might sound—the latter suggestion was put up to the M.A.P. Emergency Escape Committee more than two years ago. Have any steps been taken to develop such ideas in passenger-carrying aircraft?

E. Twickenham, Middx. D. G. H.

"FLATS REQUIRED"

Twins and Fours with Interchangeable Components

THE news that the Nuffield Flat Four engine has been shelved must have come as a great disappointment to many people. Without being unduly optimistic, hopes had been raised that this country would eventually have a 100 h.p. flat-four design available at a reasonably low price and backed by a company sufficiently important to guarantee continuous development, reliability, adequate spares and service organization, and so on.

In answer to an earlier letter of mine in your journal on the subject of ultra-light engines, G/C. Mole, of the U.L.A.A., mentions the availability of a small number of Aeronca J.A.P. engines—good little units but too low-powered to be of anything but limited use—and of some progress made with Cross and Coventry Victor designs. The fact still remains that the light power unit outlook is very grey and, as far as I know, we have no horizontally opposed designs likely to offer or reach production stage in the foreseeable future.

There is certainly a need for 50 and 100 h.p. engines. Can we afford, as a country, to be so poorly placed in this class. Some important new aircraft designs are already more or less hanging on engine availability.

The development of a flat-twin and flat-four design could very well go along side by side, using interchangeable main components, and thus reducing the development cost while preparing to meet the two needs.

A round figure of £100,000 was mentioned to me recently as representative of development costs for a light engine. This is a formidable sum for any but the largest companies to consider. Is this matter not of sufficient home and export importance to justify a development contract from the Ministry of Supply? A. G.-J. BROWN.

Dolgelly.

FORTHCOMING EVENTS

July 17th.—Southend-on-Sea Air Rally.
July 17th.—Women's Junior Air Corps: Summer rally at Hendon airfield.
July 18th.—City and County of Newcastle-upon-Tyne: Air display at Newcastle airport, Woolsington.
July 19th to 31st.—Swiss International Gliding Competitions, Samedan.
July 21st.—R.N.A.S. Arbroath (Angus) H.M.S. Condor: Visitors Day.
July 24th to 26th.—Private Air Rally for members and associate members of the Royal Aero Club at La Baule-Escoublac, St. Nazaire. (Guests of M. F. André).
July 24th and 25th.—Aero Club de Suisse: International Air Rally Blecherette airfield, Lausanne.
July 31st.—Aero Club of Orange Air Rally.
Aug. 1st.—Boroden Cup for Model Aircraft with mechanical engines, London Region.
Aug. 7th.—Air Meeting and Competitions at Ypenburg, Holland.
Aug. 7th.—Midland Aero Club: "At Home," Elmdon airport.
Aug. 28th and 29th.—Cinque Ports Flying Club: International flying meeting, Lympne airport.
Sept. 7th to 12th.—S.B.A.C. Exhibition and Display, Farnborough airfield Hants.